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The
Geographical Journal.

No. 5. NOVEMBER, 1908. Vol. XXXII.

SOME GEOGRAPHICAL ASPECTS OF THE NILE.*

By Captain H. G. LYONS, F.R.S., F.R.G.S., Director-General of the Survey Department of Egypt.

The geographical exploration of the basin of the Upper Nile was actively prosecuted during the second half of the last century, but the Mahdist rebellion closed this region to travellers in 1884, and for the next fifteen years but little could be done. In 1899 the capture of Omdurman and the defeat and dispersal of the Dervish forces once more opened the southern Sudan to European activity. In the mean time Egypt, under a stable government and an efficient organization, had increased marvellously in economic prosperity. Improvements in the irrigation system enabled the cultivator to receive regularly the water which he required, and the construction of the Aswan reservoir furnished a supply of water which sufficed, with strict economy, to meet the most pressing needs of the country and its rapidly increasing cultivation during the low stage of the river. But more water was necessary if the waste lands on the northern margin of the delta were to be reclaimed and cultivated. The Blue Nile, which falls rapidly in the autumn months, was obviously useless for this purpose, so that the study of the White Nile and its tributaries was the first step towards the solution of the problem.

During the past nine years much has been done in this direction, and now the main characteristics of the various portions of the river system have been ascertained. It may be of interest, therefore, briefly to lay the results before the Society.

In Egypt, from the earliest period of antiquity, the annual flood of the Nile was recognized as the most important phenomenon of the

* Read at the Royal Geographical Society, June 29, 1908. Map, p. 548.

year, and it attracted the attention of the dwellers in the valley both on account of its importance to them and from its occurrence in a region where the climate is practically rainless. According to Herodotus, the ancient Egyptians considered the river as flowing from two springs in the neighbourhood of Philæ island at the head of the first cataract, although this legendary source cannot have coincided with their experience, since from very early times they were acquainted with its Nubian valley, and therefore knew that the true sources lay to the south of this again. But these southern regions were poor and inhospitable as compared with the fertile flood-plain and delta of Egypt, and beyond raiding them for slaves and cattle and levying a tribute upon the inhabitants, the Egyptians interested themselves but little in the upper reaches of the river.

In the course of the eighteenth century the sources of the Blue Nile were discovered, and the cause of the annual flood was correctly determined to be the summer rainfall on the tableland of Abyssinia. In the nineteenth century the White Nile was traced to the lakes of the equatorial plateau, and the geography of its basin was sufficiently elucidated to enable Lombardini, in 1865, to sketch out the broad lines of the hydrography of the Nile.

During the last quarter of the nineteenth century the rapid increase of prosperity in Egypt, which was due to the establishment of order in the country and the introduction of administrative reforms, directed attention to the lower reaches of the river, while the Mahdist rebellion closed the Sudan to travellers. The irrigation of the country had been organized and developed so that not only were large areas of waste land brought under cultivation, but land which formerly bore but one crop in the year, produced two and even three when the water of the Nile was supplied regularly throughout the year instead of at the time of the inundation only. But at the same time that the demands of the cultivator have been constantly increasing, Egypt has experienced an unusual shortage of water, caused by the long series of exceptionally low floods which have occurred of late years, one alone since that of 1896 having been above the average, so that great difficulty has been experienced in furnishing the quantity of water needed for the crops.

The valuable cotton crop, which is sown in March and April, and which is picked in September and October, needs a regular supply of water in May, June, and July, when the river is at its lowest and the flood has not yet arrived; consequently, the irrigation engineers have been compelled to husband the water in every available way that could be devised, in order to meet as far as possible the requirements of the early summer months. But a larger supply was urgently needed, and directly Omdurman had been taken and the Mahdist rebellion had been crushed, the investigation of the upper Nile was vigorously pushed forward in order to see how the low-stage supply of the river could best

be increased. To these needs we owe the great addition to our knowledge of the regimen of the Nile and its tributaries which has been gained during the last eight years.

Many of the views which were formerly held have been modified as new information was accumulated, but we may now say with some confidence that the regimen of the basin is well known in its broad outlines, and although much detailed work remains to be done, although many lines of investigation are as yet almost untouched, it is possible now to describe the more striking geographical characteristics of the river, and to indicate some of the deficiencies in our knowledge which those who have opportunity for observation may be inclined to make good.

There are three principal and characteristic factors of the Nile regimen which exercise a marked effect upon it as a whole, and influence to a greater or less degree each portion of the river-system; but each portion also has its own peculiarities, which may greatly alter its reach of the river, and may produce effects which in turn influence other areas. It will be convenient to deal first with those factors which are of wider influence, and afterwards with those which affect a more limited area. Of the former there are three—

Firstly, the plateau of the equatorial lakes and the Abyssinian plateau—for both of these receive a heavy rainfall and supply the whole of the water which is carried by the Nile and its tributaries, that which falls on the Sudan plains being so little that it may be considered to be practically negligible as a source of supply for the river; secondly, the rainless, or at least arid, conditions which prevail over a very large proportion of the basin, since even over the greater portion of the Sudan plains precipitation is very moderate in amount; thirdly, the very low slope of the basin, which is such that an altitude of 1500 feet above sea-level is not reached on the White Nile until a point 3000 miles from the Mediterranean near Gondokoro.

Though each portion of the river has its own peculiar character, these three factors, a heavy localized rainfall, aridity in other parts of the basin, and a valley of low slope, are those which exert the greatest and widest influence.

When we begin to study the basin of the Nile as it is presented to us to day in the latest maps and in the descriptions penned by travellers in recent years, we find that in some respects this great river departs from the normal type, and exhibits peculiarities which it is of interest to investigate. Rivers have usually a steep slope near their source, which gradually becomes less as lower levels are reached, and the eroding power of the water diminishes; beyond this follows a region of deposition, where the inclination of the valley is very slight, and the river flows slowly through alluvial plains which it has formed in the course of ages; but this plain tract occurs in the Nile system at

two very distant points, the valleys of the Bahr el Jebel and the White Nile, and the valley of Egypt.

If we consider the longitudinal section of the Nile, which has now been levelled from the Mediterranean to the Victoria lake (with the exception of two short reaches, together not more than 140 miles in length out of a total length of about 3500), we find that both the Victoria Nile and the Semliki river descend very rapidly from the equatorial plateau in several series of rapids, interrupted by level reaches, until Gondokoro or Mongalla on the Bahr el Jebel. Then there follows a length of 1060 miles in which the river falls only 180 feet, or at the average rate of only 2 inches per mile. Beyond this point the slope again increases, and the river descends some 800 feet in 1200 miles in passing the several cataracts between Khartum and Aswan, after which it flows through Egypt, with a fall of from 5 to 6 inches per mile. Thus there is first an unnavigable portion, then a long and easy waterway which is separated by the cataract portion, which is partially navigable, from the valley of Egypt where the Nile has furnished the best means of communication. The comparatively recent movement of blocks of the Earth's crust on the equatorial plateau is shown by the very moderate amount of weathering which has as yet taken place, and by the very incomplete development of the drainage systems there; lakes, marshes, and river reaches of low slope, which are choked with reeds and water-plants, alternate with rapids and rocky stream-beds, down which the water rushes to deposit its load of detritus in another lake or plain-tract lower down. In this way the water which flows over the Ripon falls pours down 60 miles of rapids, and then joins the still waters of Lake Choga; at Foweira 50 miles of rapids begin, which end at the Murchison falls, 120 feet high; and immediately beyond these the material eroded from the rocky bed and brought in by tributary streams is forming extensive mud flats where the Victoria Nile enters Lake Albert. The Semliki river, after flowing northwards for some 50 miles from Lake Albert Edward, plunges down a series of rapids until it reaches the level of the Albert lake. Thus far, then, the Nile may be said to be in its mountain tract, as it scours its way down the gorges which it is carving out in the masses of granite and gneiss which form the plateau. One hundred and thirty miles beyond the Albert lake the Nile again plunges down 90 miles of rapids, the last step of the lake plateau, after which it flows gently through the plains of the Sudan.

The Sobat, the Blue Nile, the Atbara, and the Mareb, or Khor el Gash, all rise on the Abyssinian plateau at altitudes of from 6000 to 8000 feet above sea-level, and pour down their deep-cut gorges until they reach the plains of the Sudan, where they have excavated meandering channels in the alluvial plain.

The quantity of water supplied by these two great gathering-grounds

would be very large but for certain geographical conditions which reduce that from the equatorial plateau to an almost constant supply of about 12,000 or 14,000 cubic feet per second, while the Abyssinian rivers, on the other hand, must furnish about half a million cubic feet per second in a high flood.

In the majority of rivers the volume of water which they discharge increases from a very small amount near their sources to a maximum near the point where they empty themselves into the sea or an inland lake. With the Nile it is quite otherwise; not only has its volume a very marked seasonal change of volume, but from point to point of its course it varies greatly, now increasing and now decreasing as local conditions affect it. The maximum is reached when the Atbara joins the Nile, and from this point onwards, the volume diminishes by evaporation, seepage, and by the utilization of the water by the agricultural population of Egypt. The whole of this supply is furnished by a seasonal rainfall, which oscillates during the year from about 15° south of the equator to 15° north of it; in January British Central Africa receives its heaviest rainfall; in Uganda, the spring maximum occurs in April and May, while during July and August 60 per cent. of the year's rain falls on the Abyssinian plateau; in the autumn the rain-belt travels southward, again passing the equator about November, and reaching its southern limit in January. Thus the equatorial plateau has two rainy seasons and two dry seasons, while the Abyssinian plateau and the Sudan plains have a single rainy season in the summer months. North of Berber practically no rain falls, and that which the northern part of the Delta receives in winter does not reach the river.

The supply effectively furnished to the river at different points by this rainfall is shown in Fig. 1, where each division of the vertical scale represents a discharge of 35,300 cubic feet (1000 cubic metres) per second. Each of the discharge curves south of Dueim depends on a few measurements only, but the diagrams for these stations have been corrected as far as possible with the aid of the daily gauge readings; those for Dueim, Khartum, Atbara, and Wadi Halfa are from numerous actual measurements. The flood of the year 1903, which these diagrams represent, was in volume 11 per cent. below an average flood at Aswan.

The diagram is exceedingly instructive, for we see that, while the change of level of the Victoria lake makes but little difference to the discharge, a very marked seasonal variation occurs at the Murchison falls, where the low-stage volume is about 21,000 cubic feet per second, compared with 56,000 in flood, and this increase is due to the July–November rainfall on the northern edge of the plateau, since up-stream of Foweira the water-level of the Victoria Nile varies but little. At Wadelai the level varies with that of the Albert lake, and the discharge shows a maximum towards the end of the year. At Gondokoro there is a well-marked maximum in September corresponding to

that already noted at the Murchison falls, and is, like it, due to the rainfall on the northern edge of the plateau. But little of this water ever reaches the White Nile, for as the level of the Bahr el Jebel rises, the plains of the valley are flooded, and the discharge into Lake No, 500 miles to the north, hardly varies throughout the year. This 12,000 cubic feet per second represents the whole of the effective supply furnished to the White Nile by the rainfall of the equatorial plateau, approximately one-tenth per cent. of the rainfall. The Bahr el Ghazal and the Bahr el Zaraf together contribute from one-sixth to one-third of that furnished by the Bahr el Jebel, and their combined discharge represents the whole of the supply which is not derived from the Abyssinian plateau.

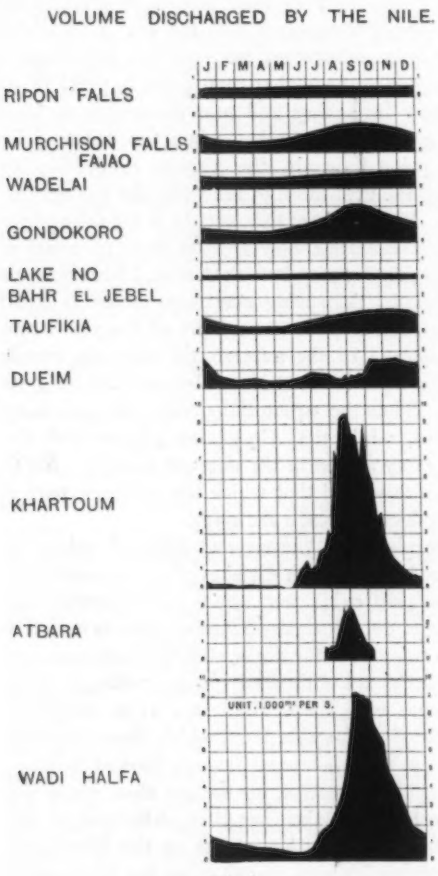


FIG. 1.

In the Sobat river we have the effect of the Abyssinian rains, but the maximum is only reached in December, owing to the delaying effect of the plains of the Pibor river, which are flooded by the summer rains, and are only drained off gradually.

The White Nile carries the volume supplied by the Bahr el Jebel, Bahr el Zaraf, and Bahr el Ghazal, together with whatever is supplied by the Sobat—that is to say, from about 14,000 cubic feet per second as a minimum to about four times that amount in flood time. But the slope of this portion of the Nile is so low that the flood water of the Blue Nile ponds back that of the White Nile, and so long as the former is discharging more than 180,000 cubic feet per second but

little of the White Nile water passes forward; it floods its own valley, forming a reserve supply, which drains off in November and December when the level of the Blue Nile has fallen. Thus the equatorial plateau has no effect whatever on the flood in the Nile valley north of Khartum, but furnishes the bulk of the low-stage supply.

From Khartum northwards the discharge diagram takes a wholly different form, for the Blue Nile is fed by the rains of Abyssinia, which are strictly limited to a short season, and may be considered as almost restricted to the months of June, July, August, and September, in which fifteen per cent., thirty per cent., thirty per cent., and fifteen per cent. of the year's rainfall occur respectively. Consequently the river rises rapidly to its maximum level, which it reaches at the beginning of September, and then falls almost as rapidly. The Atbara is supplied by the same rains, and has a similar regimen, but falls somewhat earlier, so that the maximum level at Wadi Halfa and Aswan is also reached in an average year at the beginning of September.

The Wadi Halfa diagram shows the resultant effect of the two sources of supply—the Blue and White Niles. At the beginning of the year the discharge of the Blue Nile has diminished to a very small amount; the Sobat is furnishing a considerable supply to supplement the constant volume delivered by the Bahr el Jebel, and to increase the water which had been stored in the White Nile valley, and which is now rapidly running off. From this time until May the volume of the Blue Nile and that of the Sobat decrease rapidly, the water stored in the White Nile has drained off by the end of January, and all that is available for Nubia and Egypt is the water from the equatorial plateau supplemented by such small supply as the Sobat and the Blue Nile may still bring down, as well as by a certain amount which drains back into the river from the flood plains and the sandstone which forms the valley sides. This then is the time of Egypt's greatest need, and increasing cultivation has necessitated the construction of reservoirs and regulating dams by means of which the surplus water of November and December can be stored up and supplied during the period of deficiency which lasts through May, June, and July. It is easy to see now what will cause deficiency in the low-stage supply, since that which arrives from the equatorial plateau is constant throughout the year; weak rains in Abyssinia, which end earlier in the autumn than usual, will cause the Sobat and the Blue Nile to fall to their minimum early in the spring months; the low flood will have held up less water in the White Nile valley, so that the variable sources of supply will be much reduced. If such a state of things occurs in successive years the water-table of the valley will fall, and this also will act prejudicially. History records that on more than one occasion the Nile at Cairo was so low that it could be forded in the early summer, which was doubtless due to such a chain of causes as that above described, assisted by such a distribution of

sandbanks at Cairo as allowed the water to spread over a wide bed without forming a definite channel; for series of low floods due to weakness of the Abyssinian rains are common, but a diminution of the water of the river to such an extent has rarely been recorded.

It will be seen that, with such a reduction of the water-supply in the first half of the year, continuous cultivation of the arable land was impossible until engineering works had been constructed to raise the level of the water sufficiently for it to flow into the perennial supply canals, and until reservoirs existed in which the surplus water of the autumn could be stored for later use. Previously the flood water was led on to the flood plains by canals, so that it might there deposit the silt which it carried in suspension and soak the soil in preparation for the crop which was to follow; on this newly deposited silt and the water-soaked land the seed was sown after the flood water had drained off. Land in Egypt which was not watered by the flood could not be cultivated for that year unless it was situated on the bank of the river, or wells were sunk so that the crops could be watered artificially. Hence the flood was all-important; and one that did not reach the requisite level caused scarcity, want, or even famine. Modern skill has greatly changed these natural conditions until the whole of the delta, and a large part of the valley north of Assiut, receive water throughout the year with the aid of the regulating dams at Assiut, near Cairo, and at Zifta, which enable the water to be turned into high-level canals; the Aswan reservoir furnishes a supply at the season when the normal volume of the river is insufficient for the demands made upon it. Finally, the regulating dam which is now being constructed at Esna, in Upper Egypt, will render it possible to turn the flood waters on to the higher lands in the province of Qena which are not watered by a low flood.

Man has thus so altered the conditions of the Nile supply that in future the flood will no longer have the same pre-eminent importance that it has hitherto enjoyed. In full flood there is always more water than can be utilized, and now the Esna work will enable the high land to be flooded even in years of deficient supply. It is the low-stage supply on which the cotton crop depends that is now most anxiously studied. If the flood has been large, the springs in Abyssinia provide more water to the Sobat and Blue Nile, and these two variable factors in the low-stage supply supplement the volume of the White Nile; if the rains have been weak or have ceased earlier than usual, the springs will diminish early, and the Sobat and Blue Nile give but little help in the early months of the year. It is under these conditions, when the flood of the previous summer has been deficient and the low-stage levels are abnormally low, that the rainstorms, which occasionally break on the Abyssinian plateau from November to March, are of inestimable value. Their importance has hardly been generally recognized as yet, but the investigation of the

meteorological conditions on which these storms depend is being actively prosecuted, and observations from the Nile basin and the surrounding countries are being studied. The winter of 1906–7 furnishes an instance of the importance of these winter rains, for after a flood which was 30 per cent. below the average, rain in February and March raised the river-level sufficiently to convert what would otherwise have been a very deficient summer supply into one which was sufficient for all needs.

Having indicated the geographical phenomena which characterize the Nile Basin as a whole, the peculiarities of certain portions of the river system may be examined.

On the equatorial plateau, where rain falls during the greater part of the year, vegetation grows everywhere luxuriantly, and man can, with little exertion, cultivate as much as is necessary for subsistence; streams flow in every valley, and habitations are not necessarily restricted to certain areas. Under such conditions of a moderately high temperature and plentiful precipitation, the river system does not influence the distribution of animal and vegetable life, nor the habits of the inhabitants, to the same extent that it does in more arid regions.

On leaving the plateau, however, and following the Nile northwards, we soon leave behind us the protracted rainy season, and on the plains which stretch away from the foothills rain falls from May to September, while the winter half of the year is almost dry. The annual amount of precipitation, which near the foothills reaches 50 inches, decreases rapidly as we go northwards, and at the mouth of the Sobat (lat. 9° 30′ N.) does not exceed 30 inches, and we find that near the Bahr el Jebel the three conditions of a warm climate, an almost level country, and a moderate rainfall, followed by a dry season lasting for six months, have caused the peculiar character of this portion of the basin. A ridge of granite and gneiss of no great height extends in a north-westerly direction from about Wadelai, and down its northern slope flow the streams which empty themselves into marshes occupying much of the low ground; to the eastward the plains have a greater extent, and reach from the latitude of Gondokoro to the Sobat river, broken only here and there by a knoll of granite. In the rainy season these plains are flooded for miles, and the water is slowly drained off by the meandering channels which, half choked with rank vegetation, afford an inadequate escape for the water, of which a large proportion is removed by evaporation. The Bahr el Jebel, which receives a constant supply from Lake Albert, maintains an open channel and a steady flow throughout the year; many of the others, which are bank-full in the summer months, soon fall as the rain diminishes, and by the winter consist for the most part of almost stagnant pools. Between these streams the country, which is largely flooded in the rains, can only be crossed with difficulty in the dry season on account of the lack of water.

The marshes of the Bahr el Jebel and the Bahr el Ghazal, though

very extensive, are not so vast as they were formerly represented to be, and those of the Bahr el Jebel in particular have been much reduced by the results of recent surveys. This river flows in a very shallow valley from 5 to 15 miles wide, in which at flood time the water in the lower reaches is on a level with the surface of the flood-plain, and even in the upper reaches is but little below it. The abrupt change from the steeply sloping bed above Gondokoro to the level plain below it causes most of the suspended matter to be deposited in the upper reaches, and little if any sedimentation is yet taking place in the middle and lower reaches. Consequently the sides of the flood-plains are still occupied by large lagoons, which are filled in the rainy season and slowly evaporate during the other half of the year; former bends and branches of the river, which changes of the main channel have left as isolated depressions, stand full of water and furnish suitable places for the growth of papyrus and other marsh vegetation. Five hundred miles of such a marsh-grown valley can not only take the rainfall of 30 to 35 inches which falls on it, but can receive also all the water that flows out of the main stream by numerous branches and side channels; much is taken up by the dense growth of marsh plants, and the dry winds which blow from November to April off the dry plains of the Sudan rapidly carry off a vast quantity of moisture; thus it is that the trebling of the volume discharged at Gondokoro in the rainy season has no effect on the volume which leaves the river to join the White Nile at Lake No. The descriptions of the vast marshes, the rank vegetation which blocks the river-bed, the difficulty of recognizing the true river channel, have given rise to an impression that the Bahr el Jebel has no defined bed, but is a shallow stream losing itself in the lagoons. But this is far from being the general case, for all the rivers of these plains excavate for themselves well-defined, steep-sided channels in which they flow. The difficulty of recognizing them is due to the fact that they flow almost at the same level as their flood-plains, and, being free from suspended matter, are not building them up. Conditions are therefore favourable to the growth of marsh vegetation, which extends wherever the water reaches, and which is often able to choke the smaller channels by its growth.

In such country the inhabitants are naturally hunters and fishers or cattle-owners, only a very small amount of ground near the villages being cultivated. During the rains they move with their cattle away from the rivers and marshes, to higher ground between the drainage lines, and later when the wells and ponds there dry up they return to the rivers and the larger lagoons.

In the lower reaches of the Bahr el Ghazal and the Bahr el Jebel the flood-plains lie lower, and the marshes are inundated for a considerable part of the year, from June to December; but this is due, not so much to the local rains as to the flood in the Sobat river. The country is here

so flat that the rise of water-level of 7 or 8 feet in the Sobat at flood stage raises the water-level up-stream for many miles in the river and the lagoons; this facilitates the detachment by storms of wind of the plants growing in the marshes from the bottom. When once set free, these masses of vegetation drift into the main river channel, where they may be arrested at a narrow part or at a sharp bend. More masses are constantly arriving, and soon the block extends across the channel, and in time may completely close it. These sadd-blocks have occurred principally in the last hundred miles of the Bahr el Jebel, a few only having been formed near Ghaba Shambe, where the wide marshes in which the Bahr el Zaraf takes its rise cause a rise of the river-level of the Bahr el Jebel in the rainy season, and so facilitate the setting free of the grass, reeds, and water-plants which may then form the sadd-block. A rise of water-level in the lagoons is therefore an important cause of sadd-blocks, while stormy weather and a narrow meandering river furnish the rest of the necessary conditions.

In the Bahr el Ghazal marsh region the rivers are for the most part shallower, and the vegetation which blocks them is oftener growing on the bed of the stream than drifted into it as loose material derived from the lagoons. But for all this region from Meshra el Rek to the mouth of the Sobat, there is no doubt that the flood in the latter river is the important geographical factor. Although the rains cease on the Abyssinian plateau after September, the level of the Sobat in its lower reaches slowly rises until the end of November, and only begins to fall towards the end of December. This is due to the water which floods the plains to the south of the Sobat through which the Pibor river flows. Miles of country are flooded to a depth of about 2 feet, and are slowly drained off into the Sobat as the supply from the plateau diminishes, so that the level in the main river is maintained. The effect of the Sobat flood is felt even as far as Meshra el Rek on the Bahr el Ghazal, for here too the variation of the water-level follows that of the Sobat exactly in rising very slowly from June, in attaining its maximum level at the beginning of December, and in falling rapidly at the end of that month. The effect of this regimen on the discharge at Taufikia is shown in Fig. 1.

The Sobat, which rises on the southern portion of the Abyssinian plateau at an altitude of some 7000 feet, descends very rapidly to the low-lying Sudan plains, through which it flows in a well-defined channel. The slope here being low, most of the suspended material is deposited in the middle reaches, to form sandbanks which render navigation difficult at the low stage. It is characterized by the late maximum level which has been already alluded to, and which notably augments the volume of water available for Egypt in January and February. In April and May its supply is small, but in favourable years it is a valuable addition to the White Nile.

Although the country of the Bahr el Jebel and the lower Sobat is a vast plain having a very slight inclination, the flattest portion of the Nile valley is that between the mouth of the Sobat and Khartum. Here, the river falls, at low stage, only 26 feet in a distance of 515 miles, or 1 in 107,000, equivalent to little more than half an inch a mile; at high stage, when the Blue Nile has risen 26 feet, the water of the White Nile is held up so that the water-slope from Taufikia to Khartum is only 11 feet in the same distance, or 1 in 255,000, which corresponds to about a quarter of an inch per mile only; but this slope occurs in the southern portion only, for from Renk to Khartum, a distance of about 300 miles, the river presents a level surface, and this portion of the valley is a vast reservoir held up by the flood-water of the Blue Nile.

The river here flows through a vast plain, with the low hills of Kordofan on the west, and those of the centre of the Gezira on the east, which divide it from the basin of the Blue Nile. Both these hill masses consist of granites, gneisses, and other crystalline rocks, representing the worn-down stump of a hill range which in former times was of much greater importance; long-continued erosion has worn them away, and streams have distributed the material to form the alluvial plains of the White Nile. On these numberless herds of cattle and sheep are raised by the tribes which inhabit them, and in some parts considerable crops are raised in the rainy season; but the rainfall rapidly diminishes as we move northwards, and at Khartum it only amounts to about 4 or 5 inches annually, which falls in the four months June to September, the remainder of the year being hot and dry. We have now left the thorn forest and the savannah type of country in which the gum acacia predominates, for north of lat. 16° even these become rare, and we enter the rainless desert of Northern Africa.

At Khartum very different conditions are encountered; not only does the rainless region begin immediately north of it, but the heavy rainfall of Abyssinia furnishes the flood of the Blue Nile which both waters the lower reaches of the river and carries down to them the red-brown silt which forms the flood-plains of Egypt. The great volume of the Blue Nile flood, as compared with that of the White Nile, has already been alluded to, as well as its occurrence during a short season of four months in the summer.* After leaving the hills of Abyssinia, the Blue Nile flows in the channel which it has eroded in the alluvial deposits which overlie the crystalline rocks of the region, and the banks are of sufficient height to prevent the flooding of the lands which border it. The slope of the river at low stage is about 1 in 3000 between Fazogli and Roseires, but decreases to 1 in 8000 below the latter place.

* Cf. *Geographical Journal*, September, 1906; and 'Physiography of the Nile Basin,' chap. vi. Cairo: 1906.

It is highly probable that on the whole the river is slowly eroding its bed as the cataracts below Berber are being worn away, but the change of slope between Singa and Sennar is very remarkable. Here the slope is only 1 in 10,900, while up-stream of this reach it is 1 in 8300 and below it 1 in 9100. Since, so far as is known, there is no ridge of hard rock at this point to account for the change of slope, a gradual warping of this part of the country may be the cause, and the extreme meandering of the parallel streams, the Rahad and the Dinder, in the same region gives some support to the hypothesis.

Below Khartum the river enters the region of the cataracts, which are generally described as being six in number; but this is not strictly accurate, for one portion, which is but a deep and narrow gorge, is included as the sixth cataract, while, on the other hand, the important series of rapids which occur immediately down-stream of Abu Hamed are ignored. At no point is there any considerable vertical fall, but each so-called cataract consists of one or more series of rapids, in which the water-slope is from about 1 in 2000 to 1 in 800. In every case the rock channel is formed of granite, gneiss, or crystalline schists, which have usually been greatly crushed by earth-movements, in consequence of which lines of weakness have been developed, thus determining the direction of the various water-channels, which often follow the line of intrusive dykes.

As the river has cut its way down through the overlying sandstone of Cretaceous age, it has met with portions of the uneven floor of crystalline rocks on which the sandstone was originally deposited, and the position of these rocky ridges have determined the position of the cataracts; but the directions and positions of the water-channels, and of the different rapids, are due to the structure of the rock masses themselves as they now exist, after the crushing and dislocation to which they have been subjected during the past history of the continent.

Up-stream of each of these outcrops of harder rock, which form a series of steps down which the Nile flows, there is a reach of low slope, in which the river flows placidly through the sandstone region in the narrow alluvial plain which it has deposited during past centuries. These barriers of hard rock seemed to promise suitable sites on which masonry dams might be erected, for the purpose of storing the additional water which was needed for the irrigation of the cultivable lands in Egypt; but a survey of the whole length of the river from Khartum to Wadi Halfa, and the detailed examination of the three reaches which offered most prospect of storing the necessary quantity of water, showed that nowhere was there a site offering the advantages of that at the Aswan cataract, while in more than one of the sites examined the rocks had been so crushed and fissured as to afford but an unsafe foundation for large works.

Fifty miles below Khartum, the Nile, which has been flowing through

a sandstone plain, enters the Shabluka gorge, which is 7½ miles long, and cuts directly through the hill mass of this name. This is commonly called the sixth cataract, but the total fall of the water-level at low stage is only 28 inches in this length, and it is the rush of the whole river through a deep and narrow channel which causes the troubled water and suggests a steep slope: the depth is very great, being as much as 100 feet at one point in the middle of the gorge in January, and 80 feet at another point near the down-stream end. It is very remarkable that the river should have taken its course through this isolated hill-mass of crystalline rocks instead of excavating a channel through the softer gneisses which now form the low ground around. This point demands detailed investigation, but there is evidence that the gorge existed in some form at a very remote period; that it was filled with sandstone in Cretaceous times, and that in the modern erosion of the country the river has reoccupied the ancient gorge by excavating the sandstone which filled it; further examination, however, is needed before this question can be considered as finally settled.

The next cataract, the fifth, begins about 30 miles below Berber, and consists of three or four separate groups of rapids. Together with the intervening reaches of low slope, they occupy nearly 100 miles of valley in which the river descends 82 feet; beyond this a reach of low slope for 30 miles extends to Abu Hamed. This reach up stream of Abu Hamed seemed at first to offer many advantages for a reservoir, but a detailed survey showed that the valley opened out widely at the northern end until any economical storage of water in it became impracticable.

Here the Nile makes its great bend to the westward, flowing at times even southwards; but the causes which determined this in the past have yet to be found, and careful examination of this portion of the basin is needed to lead to a solution of the problem. From Abu Hamed to Merowe, a distance of 150 miles, the river flows principally over crystalline rocks, and rapids occurs frequently at short intervals. In the first 17 miles the river falls 60 feet, and afterwards follows an irregular course through these rocks for another 125 miles before reaching the head of the fourth cataract at Shirri island, 10 miles below which is Merowe. Shirri island was specially examined as possibly providing a site for a dam, but the valley between this point and the cataract at Abu Hamed was not large enough to contain the necessary volume of water (see Fig. 2).

A long reach then follows, in which, for 160 miles, sandstone rock alone occurs on either side of the alluvial plain, and it is not until Abu Fatma, 40 miles north of Dongola, that the third cataract commences.

From this point to Wadi Halfa the rapids which are collectively grouped as the third and second cataracts, occupy a great part of the river's course. In general character they have much in common with

FIG. 2.—DUMAG ISLAND, UPPER END OF FOURTH CATARACT.
(Photo by E. M. Douston.)

each other and with those which have been already mentioned, but each has peculiarities of its own, which, however, exceed the scope of the present paper. The erosive action of the mass of silt-laden water which pours down them in flood, and which amounts to nearly half a cubic mile of water per diem when the river is in high flood, has for many thousand years been wearing down the rocks of these rapids, and carrying the material to the delta of Egypt and to the sea. The character of these rapids may be well seen in various parts of the third cataract, and among those which occur between it and the second or Wadi Halfa cataract. At Hannek, in the third cataract (Fig. 3), bands of granite traversing the gneiss, which forms the fundamental rock, give rise to obstructions to the river's flow. A point at the upper end of the Dal cataract seemed to offer certain advantages as a dam site. Here the rock is a granite, which has been highly crushed along certain lines, leaving uncrushed masses as kernels in an envelope of gneiss; the result has been to form a number of small elongated or rounded islands of granite, between which the water has eroded its channels in the softer gneiss (see Fig. 4). These rocks vary greatly in the resistance which they offer to erosion, and while depths of 15 and 20 feet were found at low stage in certain channels, at other points not far distant depths of 60 and 70 feet were not uncommon, and at one place a depth of as much as 130 feet was recorded. Again, at the Atiri rapids south of Semna, an intermixture of granite and schists is the cause of the unequal erosion which has left the rocks and islands of the harder material to obstruct the fairway of the river (see Fig. 5). At Semna, about 12 miles above the second cataract, inscriptions on the rocks appear to show that since 2000 B.C. the river has lowered its bed by about 27 feet, and recent excavations in Nubia also indicate that, since the time when pre-dynastic man inhabited the valley, the river-level has fallen, doubtless in consequence of the erosion of the Aswan cataract, while the existence of terraces of water-rolled detritus at several levels in the side valleys furnishes confirmatory evidence of this.

Throughout this region a narrow valley in a rainless climate offered little opportunity or encouragement for a population to develop and thrive. In the southern portion sufficient rain falls in the form of summer storms to enable the nomad Arab to find water and forage in the valleys sufficient for himself and his flocks, but in the northern part the country is too inhospitable for him to do more than move through it between the fertile valley of Egypt and the Sudan region of the monsoon rains, except among the hills which border the Red Sea, where water is more plentiful. Here and there in the desert are wells and in the El Kab depression, to the west of Dongola, water is found at a short distance from the surface. The origin of this water is of much interest; but as yet verified facts are so few that we are left to choose between several more or less probable hypotheses. It is, however,

certain, from such measurements as have been made, that there is a considerable loss of water between Khartum and Wadi Halfa in flood, which is greater than can be accounted for by evaporation. Much of this water makes its way into the alluvial flood-plain, and it seems more than probable that it also percolates into the porous Nubian sandstone. In the rainless Nubian climate the underground water-table must slope away from the river, and this water must find its way into the lower layers. In default of any accurate levels or borings in the desert, no more can be said at present, but the observations on discharge made at the Aswan dam should, when published, show what loss takes place in this manner in the Wadi Halfa-Aswan reach. It has, moreover, been shown that when the river-level falls below that of the water-table in the flood-plain, water drains back into the river at low stage, and Mr. Craig * has shown that this may amount to as much as 3500 cubic feet per second between Khartum and Wadi Halfa at the lowest stage of the river. As the whole discharge is not more than six or seven times this amount at this season, it is not an unimportant factor.

The remaining portion of the Nile basin, consisting of the valley below the Aswan cataract and the Delta, differs very markedly from the regions which have been referred to. A valley of rich alluvial soil, some 5 to 10 miles wide and 600 miles long, and a delta of the same character, now supports an agricultural population of exceptional density, which numbers on the average about 1100 persons to the square mile. This tract of country possesses very marked characteristics, which have undoubtedly affected in a high degree the customs, the habits, and the character of its inhabitants. As a watered valley in the midst of an absolutely arid region, it must have been occupied in very early times, and when the remains of palæolithic man in the valleys and on the desert margins have been more fully collected and studied, it should be possible to glean important information concerning his occupation of this part of the world. At that early time the valley was probably occupied for the most part by jungle and marsh, conditions approximating somewhat to those of the Bahr el Jebel of to-day, and early man may have lived on the desert margin, fished in the river, its lagoons, and backwaters, and hunted and trapped animals in the jungle which bordered them, much as the Dinka negro does to-day. The earliest representations that we possess of the ancient inhabitants show, in their crowns, their ornaments, their ceremonial dress, and so forth, evident traces of their former occupations of hunting and fishing before they became an agricultural people. As the deposit of silt by the waters of the annual inundation continued, the banks of the river would be gradually built up, the flood-plains would extend at the expense of

* 'The Nile Flood and Rains of the Nile Basin, 1906.' Survey Dept., Cairo. 1907.

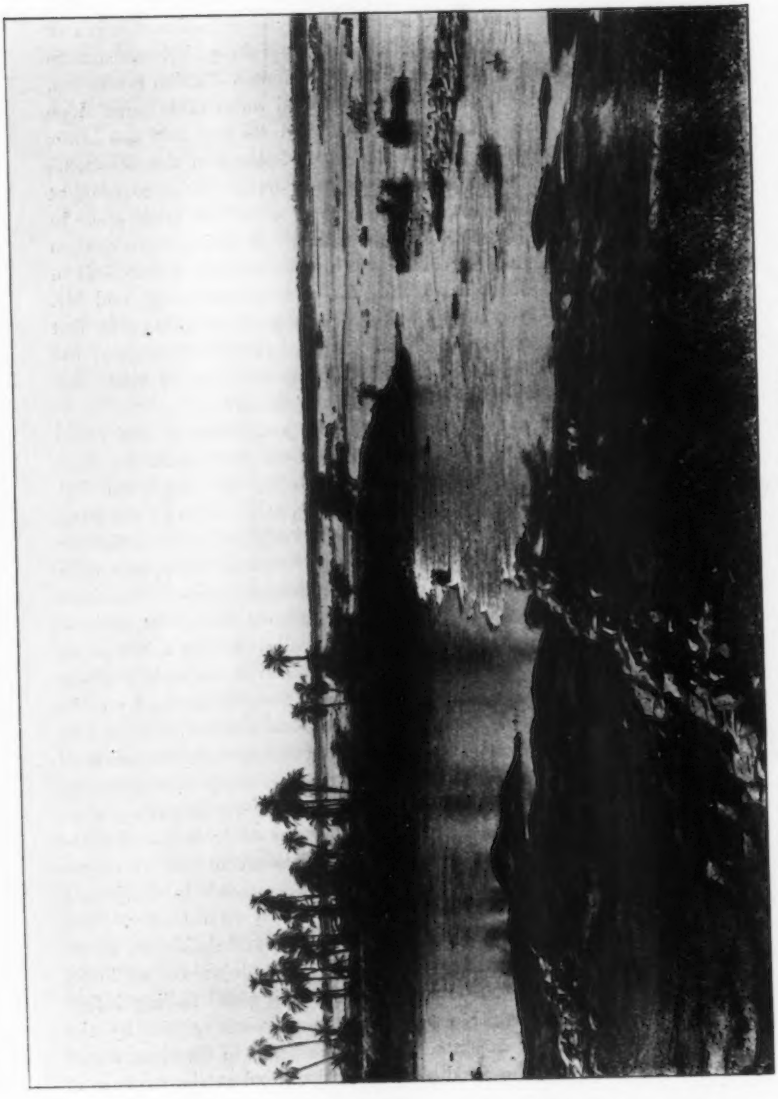


FIG. 3.—A PORTION OF HANNEK CATARACT.
(Photo by H. M. Dawson.)

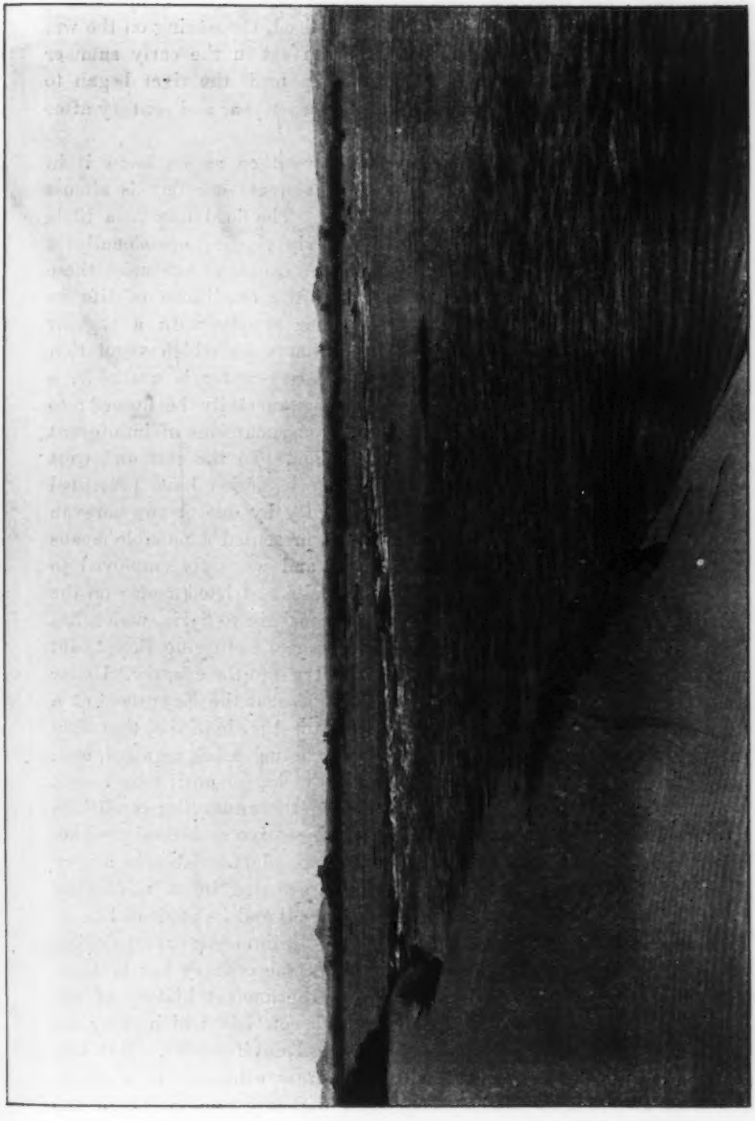


FIG. 3.—A PORTION OF HANNEK CATARACT.
(*Photo by E. M. Dowson.*)

FIG 4.—A PORTION OF DAL CATARACT.
(*Photo by E. M. Dowson.*)

the lagoons, and land within reach of water would become available for agriculture; and from that time onwards the yearly cycle of operations, the inundation of the land by the annual flood, the sowing on the wet mud as soon as the water drained off, the harvest in the early summer months, and the period of waiting from then until the river began to fall after the next flood, repeated itself year after year and century after century without appreciable variation.

In the rainless climate of this region, weather, as we know it in Northern Europe, may be said to be non-existent—one day is almost exactly like the next and the one before it. The flood may be a little higher or a little lower than in the previous year; occasionally it may fail or be dangerously high, but in the course of centuries these slight variations are of small effect, and the conditions of life in Egypt are exceptionally constant: a water supply with a regular seasonal variation, no rainfall, a warm climate in which vegetation can grow throughout the year if the necessary water is available, a rich alluvial plain on which water-channels can easily be formed; to these are to be added exceptional freedom from incursions of immigrant races of greater power, or higher organization. To the east and west lie the deserts which throughout the historic period have presented a barrier which could be passed with difficulty by one or two caravan routes. To the south the Nile valley itself presented a possible means of ingress, but one which could be closed, and was only employed to a moderate extent. The marshes of the Delta restricted traffic on the north, and even the road along its eastern margin to Syria, which has been trodden by numerous armies both leaving and entering Egypt, did not offer exceptional facilities for a ready entry into the country. Under these circumstances it is not surprising to find that the Egyptians at a very early period settled down to an agricultural mode of life, that they early perfected the ordinary operations which such a life required, and, having done so, preserved them with but little change until very recent times. Simple methods were well suited to the unvarying conditions among which they lived, and there was no incentive or necessity which might compel them to modify them. This people furnishes in a very marked degree an example of an organism growing in an unvarying environment to which it had early adapted itself and its mode of life.

To the geographer such a case is especially interesting, and during recent years the archæological exploration of the country has brought to light a store of information concerning the ancient history of the Egyptians, their customs, and their mode of life which may be profitably studied in relation to their physical environment. But this is a very wide subject, and I will only draw attention to a single aspect of it which is directly connected with my own work in the country—the measurement of the land. The annual flood, rising in July within a few days of the same date year after year, and falling

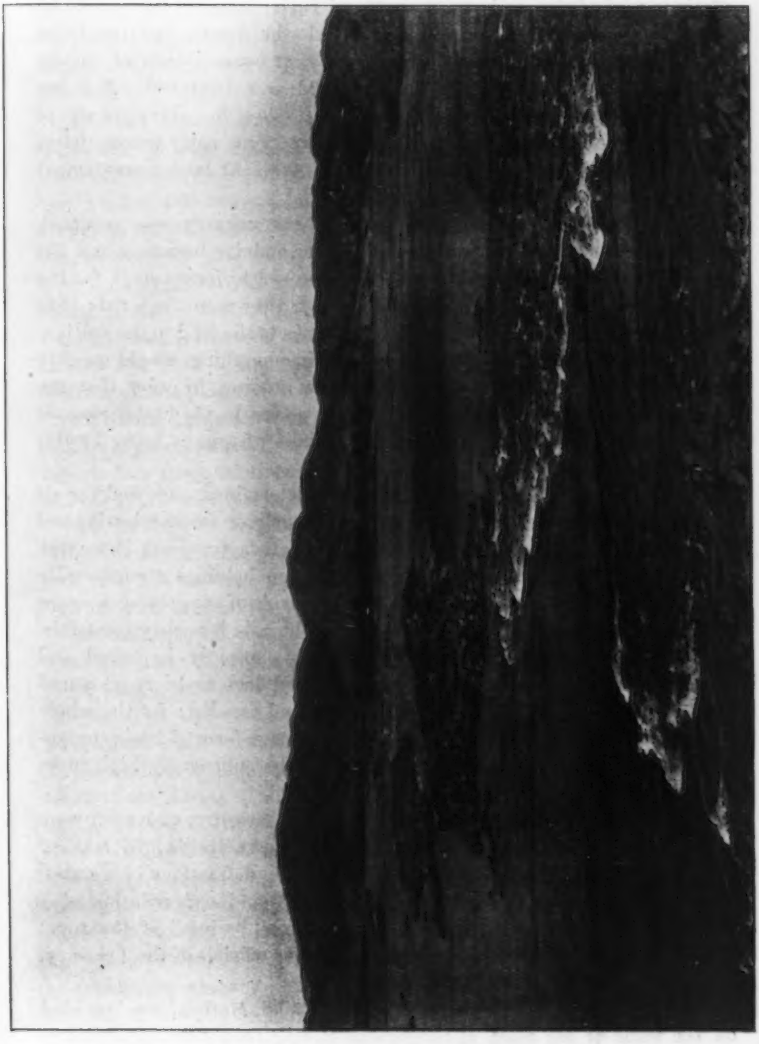


FIG. 5.—THE ATBRI RAPIDS.
(*Photo by E. M. Downton.*)

in October with equal regularity, has, from the earliest times, caused an invariability in the field-seasons which must have reacted on the character of the people. This unvarying cycle of their water-supply, of their agriculture, and consequently of their domestic life, combined with the freedom from immigration which the deserts and the Delta swamps ensured, laid the foundations of that conservatism of custom and character which the Egyptian has always displayed. Nor has this greatly changed, and there exist to-day in every phase of Egyptian life traits which have come down from early times almost unaltered; the examples furnished by the science of land-measurement are as striking as any that we know.

As soon as any considerable tract of the country was occupied, attempts would be made to control the river and its branches, and the natural spills and backwaters would be improved to form canals for the purpose of leading the flood-waters wherever they were required; thus the water would be supplied along certain lines to the land under cultivation, and this, as well as the convenience in ploughing, would quickly lead to the development of the long narrow holding, in order that the owners of small areas should have direct access to the water-channel which served them; the definition of the unit of area as being 1 cubit by 100 cubits shows this.

The geographical factors of the valley determined once and for all a state of things which the surveyor, consciously or unconsciously, had to take into account if his work was to be satisfactory, and it may be summarized as—a narrow belt of country where holdings are unusually small and the land is of high value, being capable of supporting a dense population, but only in so far as the water of the Nile is readily accessible.

The method, once decided upon, would be rapidly improved and developed by constant practice, since the land had to be re-measured annually after the waters of the inundation had receded; for the whole country was at first under a more or less primitive form of basin irrigation, and only the banks of the river would be sufficiently high to be cultivated during the flood season.

As early as the first dynasty (3400 B.C.) the measures of length were in regular use, for on the Palermo stone we have the height reached each year by the Nile flood recorded in cubits and fractions of a cubit, while the stretching of the (measuring) cord at the foundation of a temple is mentioned. Every two years a "numbering" of the royal possessions was made throughout the land by the officials of the Treasury, and this would be a sort of verifying survey.

About 3000 B.C. the property of a high official, Methen, was recorded on the walls of his tomb at Saqqara as having been duly registered to him in the royal archives or registry.

Another of the tombs at Saqqara, that of a certain Mes, furnishes us with information of exceptional interest. Certain lands near Memphis,

which the Pharaoh Amosis (1580 B.C.) had conferred on an ancestor of Mes named Neshi, were, during the minority of Mes, claimed by a certain Khay as his property. A lawsuit followed, in which Khay produced false title deeds, whereupon Nubnofret, the mother of Mes, appealed to the official registers, saying, "Let there be brought to me the registers from the treasury and likewise from the department of the granary of Pharaoh."

In later times, about 900 or 850 B.C., the register of the lands and springs in the oasis of Dakhla is referred to in an inscription which tells of a lawsuit concerning the ownership of a spring; nineteen years elapsed before a decision was obtained. Thus the owner's name, the area of the property, its position, and the tax due from it were regularly recorded, and, in the New Empire at least, duplicate registers were kept in the treasury and the royal granary. Boundaries were described as north, south, east, and west, without being any more exactly defined, just as in the Egyptian title-deeds of to-day, and the Nile, the desert, or the land of such and such a landowner were recorded as being situated on the confines of the plot referred to. A monarch of Assiut, about 2300 B.C., says that he irrigated by a new canal the high land which otherwise could not be cultivated. The vizier Rekhmara, in his tomb at Thebes, records how cases of disputed ownership in land were to be dealt with, and all approved titles registered, but unregistered claims were ignored.

At El Kab, in the tomb of Sebek-nekt, land is divided into low-lying, of which there were twenty "thousands," and land on the high ground (one hundred and twenty "thousands"): the unit which the sign for "thousand" represents is ten *arouræ*, or about 6·3 acres.

At every period, therefore, of ancient Egyptian history, the land was measured and recorded with considerable accuracy; property was dealt in regularly, and an elaborate system of registration was maintained. No map of landed property in ancient Egypt has come down to us, but on the tomb-walls we meet with representations of land-measurers at work. Their methods of land-measurement are represented on the walls of the tomb of one Menna at Sheikh Abd el Qurna, in Thebes, a land overseer and inspector of the boundary-stones of Amon. The scene depicted shows two chainmen measuring a field of corn with a long cord, on which are knots or marks at intervals which seem to be about 4 or 5 cubits in length; each also carries a spare cord coiled up on his arm. Beside them walk three officials, who carry writing materials, and who are accompanied by a small boy carrying writing materials and a bag in which are probably documents and plans referring to the property. An old man and two boys also accompany the surveyors, and a peasant brings a loaf of bread and a bunch of green corn.

A similar scene is pictured on the walls of a tomb belonging to a certain Amenhotep, also at Sheikh Abd el Qurna. Here only one man accompanies the chainmen, each of whom, as usual, carries a spare cord.

The figures are larger than in the tomb of Menna, and though they are now much damaged, it is possible to see clearly that the cord terminated in a ram's head.

The statue of the priest Pa-en-anhor from Abydos, and now in the Cairo Museum (Cat. No. 4875), shows him in a kneeling position and holding a rolled-up measuring-cord, at the end of which is a ram's head.

Of their topographical maps two alone have come down to us drawn on papyrus. One of these, which is only partially preserved, represents the mining district east of Quft, and dates from the time of Ramses II., the other is probably a plan of one of the mining centres lying further to the south. Two valleys run parallel to each other between the mountains, one of them being covered with blocks of stone and bushes, while a winding valley unites them. One valley and a narrow pass are said to lead to the sea; the name of the place which is reached by following the other valley is not decipherable. Other features in the map are the mountains in which gold is found, and others where it is worked; a sanctuary of Amon, as well as miners' houses and a water-tank or well, round which is shown a patch of cultivation, are indicated.

Of accurate measurements on the ground we have numerous examples in the pyramids, temples, and rock-tombs; the pyramids of Giza furnish perhaps the best known and most fully studied instances.

Not only were the Egyptians of these remote times competent to measure lands and lay out large buildings, but they had attained a very satisfactory accuracy in levelling, and of this the pyramids of Giza again furnish proof. Borchardt, in his paper on "Nilmesser und Nilstandsmarken," * adduces many facts in support of the view that they carried out a line of levelling from the head of the Delta to the first cataract in connection with the nilometers which were built at every important town; and this, too, was done with a very fair accuracy, since the average slope from the scales on these nilometers works out at 1 in 14,440 against 1 in 13,700, as given to-day by the levels of the Irrigation Service. The instrument used was a right-angled isosceles triangle of wood, with a plumb-line attached to the apex; it was doubtless used on a long wooden straight-edge, which, in its turn, rested on pickets. In this way levelling of a very fair accuracy could be rapidly executed.

The principal unit of length from the earliest times was the cubit of 20·6 inches, containing 7 palms or 28 fingers, which was called the royal cubit, distinguishing it from the short cubit of 6 palms.

For land, a measure of 100 royal cubits, named *khet* or *khet-n-nuh*, "a reel of cord," formed the unit, while the usual itinerary measure was the *ater* or *schoenus*.

The areas of the fields were reckoned in squares of the *khet*, or 100

* *Abhandlungen d. königl. preuss. Akademie.* Berlin. 1906.

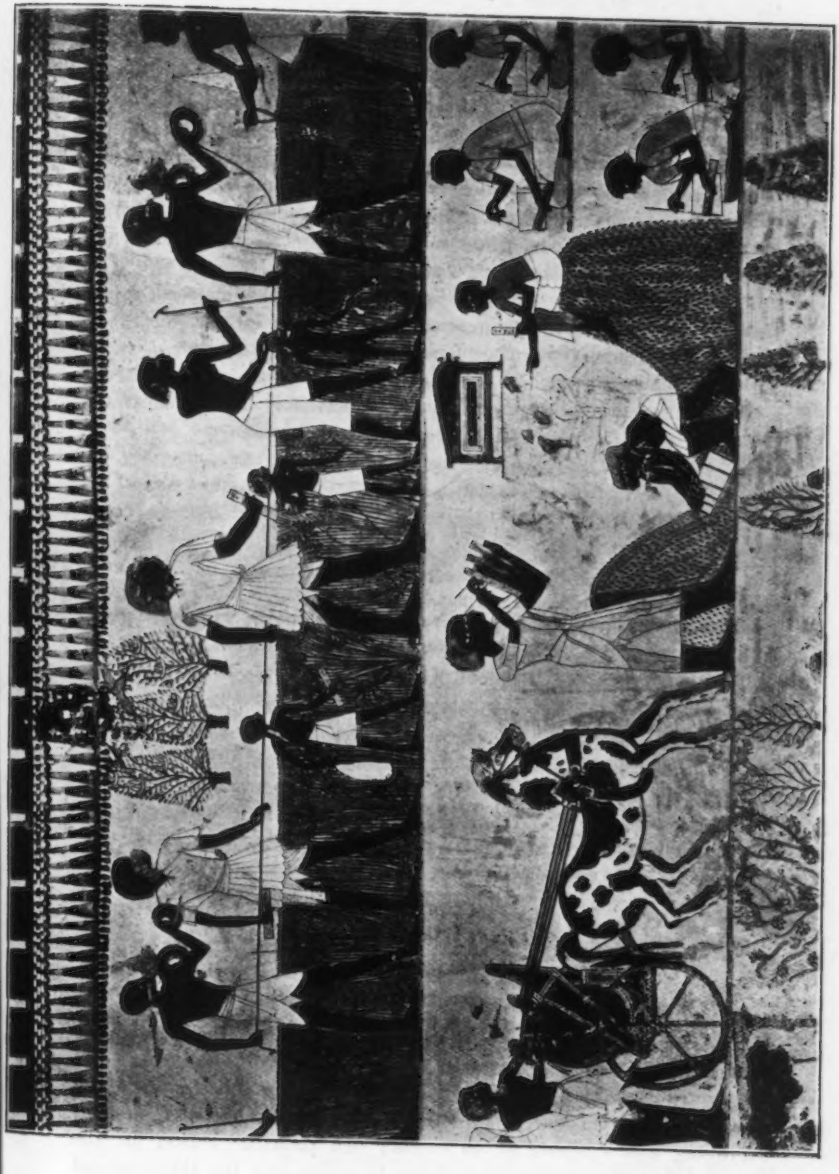


FIG. 6.—EGYPTIAN LAND MEASURERS, THEBES.
(*Photo by Dr. Borchardt.*)

royal cubits, such a square being called in Egyptian *set*, and in Greek *aroura*. It was considered as being composed of 100 strips, each 100 cubits long by 1 cubit in breadth. The divisions of the *set* or *aroura* were the half, the quarter, and the eighth, after which the cubit became the unit; but in late Ptolemaic times the subdivisions were continued to the thirty-second, and the Greeks carried them further to the sixty-fourth part. A half *aroura* was also in use in late Egyptian times, and this exemplifies the approximate methods used in computation, for it was called *remen*, or the upper arm. This was a measure of 5 palms, whereas the royal cubit contained 7 palms, so that their squares contained 25 and 49 square palms respectively, or a proportion of nearly one to two. At Aneiba, a village nearly opposite Ibrim in Nubia, there are some tombs in which the extent of certain estates is represented by notched rectangles. Each subdivision thus formed represented, doubtless, a *set* or *aroura*. Small areas, such as a well or tank, were given in square cubits.

Thus, the units in use in ancient times for land-measurement were:—

Length—royal cubit		= 20·6 inches
khet = 100 cubits		= 57·2 yards
Area—square cubit		= 0·305 sq. yds.
cubit of land = 100 sq. cubits		= 30·5 „
set or aroura = 100 cubits of land		= 3050 „
the "thousand" or 10 arouræ		= 6·3 acres

In Roman times, we have several additional units, which are given in a papyrus (No. 669) found at Oxyrhynchus (Bahnessa) in 1903, by Prof. Grenfell and Dr. Hunt, and which dates from about 290 A.D.

2 palms make a			λιχάς.
3	„	„	*σπιθαμή*.
4	„	„	*πούς*.
5	„	„	cloth-weaver's cubit.
6	„	„	public and a carpenter's cubit.
7	„	„	nilometer or royal cubit.
10	„	„	*βῆμα*, or the distance of the outstretched feet.
3 cubits make a			public *ξύλον*.
4	„	„	*ὀργυιά*.
?	„	„	*κάλαμος*.
$6\frac{2}{3}$	„	„	*ἄκαινα*.
40	„	„	*ἄμμα*.
96	„	„	*schœnium* of land-surveying.
100	„	„	*schœnium*.

The *schœnium*, like the *khet* in earlier times, was the side of the square *aroura* or *set*, and measured 100 royal cubits of 20·6 inches; and the *aroura* contained about 3050 square yards, or five-eighths of an acre. But the papyrus just quoted says that *schœnium* used in land surveying was a square of 96 cubits; one probable reason for the change being the greater convenience in estimating the thirty-second and other fractions of the *aroura*.

But these measurements are not those which are in use to-day. Though the ancient measure of the *aroura* is referred to in papyri as late as the sixth and seventh centuries, in an Arabic papyrus from the Fayum, dated 724 A.D., the feddan is used to define areas. It is very remarkable that the older measures, which had been so long in use, should have been within a hundred years, or rather more, completely replaced by one of Syrian origin, which has remained in use ever since.

But little is known of the manner in which land was classified in ancient Egypt, but papyri, of Ptolemaic age, from the Fayum give full details of the system which then existed. There was very little difference between it and the present-day practice. Private land was classed separately from that of the government; canals and canal-banks were shown; land which had deteriorated was transferred from one class to another; in fact, the measurement and registration of land two thousand years ago differed but little from the present practice, except that the methods of computation were approximate instead of being exact, but even this change is limited to the present survey, and has not yet become the universal practice.

In early historic times Egypt was largely agricultural, but a great extent of marsh and lagoon still remained which was flooded annually, and retained water to a greater or less extent throughout the year. As time went on man controlled more and more the flood waters, and extended his cultivation as the marshes were silted up or drained. When the whole of the flood-plain was under cultivation as well as the greater part of the Delta, the annual flood was of paramount importance, and the extent to which its waters could be led determined the maximum area which could be cultivated. Now modern engineering science has supplied water at all seasons of the year to both the valley and the Delta, so that the flood has lost its importance, and the low-stage supply of the river has become the first consideration, so much so that heavy expenditure is incurred to augment it in every possible way; the natural resources of the country have been immensely increased by fully utilizing a climate which favoured the growth of vegetation throughout the year, if water was obtainable.

The PRESIDENT, before the paper: The subject of to-night's paper is Egypt, the Nile valley, and the land bordering on the Nile. Whilst he has been Director of the Egyptian Survey, Captain Lyons, the author of the paper to-night, has had excellent opportunities for studying the various problems connected with that great river. During that period, a great deal of country has been well mapped; many of the geological problems have been attacked; and the solution of many of the questions connected with the archæology has been greatly facilitated by his work. He has, therefore, made admirable use of the opportunities offered to him. In listening to Captain Lyons on this question, we are listening to one who speaks with greater authority on questions connected with the hydrography of the Nile than any other man in Europe.

Sir GEORGE DARWIN: I cannot add anything to the very interesting account

of the Nile which Captain Lyons has just given us. In the last part of his address, however, he showed us some pictures of ancient Egyptian instruments for surveying. This shows that the department over which he has presided with such conspicuous success is of great antiquity. The few words which fell from him indicate that he will agree with me in thinking that we are too apt to believe ourselves far superior to our ancestors. No doubt with our mechanical appliances we obtain more accurate results than they did, but they also attained results of great accuracy, although with greater trouble. This survey of the time of the Pharaohs is very ancient, but there must, in the mean time, have been a long interval when the survey practically ceased to exist, and the Egyptians have to thank the present occupiers of Egypt for its re-establishment. Although a cadastral survey does not loom largely in the popular estimation, yet it is a thing on which the prosperity of an agricultural community depends to a very large extent. About three years ago, when I visited Cairo, Captain Lyons showed me his department, and I there had the pleasure of greeting some of my Cambridge friends and pupils who are now working under him. The beautiful maps which I saw there are second, I think, to none, and I was struck with wonder at some of those maps which exhibit the extraordinary subdivision of property, as you have just now seen exhibited on the screen. It may not, perhaps, be obvious to every one how great is the difficulty with which the survey of Egypt has had to deal in making maps of such properties, and I do not think that any other survey has dealt with such a task more successfully. I suppose that the area in which these excessively long and narrow holdings prevail is of considerable size. Now if we imagine that the whole county of Yorkshire were laid out in allotment gardens, and that the peace and prosperity of every holder of an allotment depended upon the accuracy of the Ordnance Survey defining its borders, we should form a picture of the difficulty with which Captain Lyons has dealt so well. He will no doubt correct me if I am wrong, but I believe that the delta of the Nile is a region in which surveying has its peculiar difficulties, for there are no elevations from which angles may be measured, and no conspicuous objects; this makes the task of the surveyor a very arduous one.

Another branch of the survey has a special interest for me who am concerned in geodesy. It is necessary that there should be a backbone of accurate triangulation for the survey of any country. Such a basis would be afforded by a triangulation along the Nile valley of the first class of accuracy. Triangulation is now in progress in Egypt, and I doubt not that, within a few years' time, a triangulation of the first order of accuracy will be carried up the Nile, and away to the south, until it reaches German territory. This will afford the requisite backbone for the accurate mapping of the whole of Africa, at least on its eastern side. It will ultimately meet that great triangulation of which so much has already been carried out in the south. Although I do not think the fact has yet been published, I may tell you that at the present moment the survey along the 30th meridian of east longitude has been carried out from the Cape Colony northward to within 70 miles of German territory. The observations for the most northerly portion are not yet finally reduced, but that will be finished shortly. Within a year or two this triangulation will certainly have been carried up to Lake Tanganyika. There is also little room to doubt that the German Government will soon take up their part of the task and carry the work further northward. Within a generation from now, the main survey from the south will be extended until it reaches the triangulation of which Captain Lyons is laying the foundation.

I feel that I have already detained you too long, and in concluding I should

like to congratulate Captain Lyons not only on his interesting paper to-night, but still more so on his magnificent services to Egypt in the conduct of the survey of that country.

Mr. HOGARTH: I cannot claim to be a first-rate authority on the Nile, least of all geographically. Like Sir George Darwin, I should like to congratulate Captain Lyons. I have not known which to admire most, the clearness with which he explained those difficult diagrams, or the remarkable width of his knowledge. It is of course well known, if he were not Director of the Survey, that he might be Director of the Cairo Museum of Archæology. Perhaps the best thing I can do is to ask Captain Lyons one or two questions which must have occurred to everybody, and to which I hope he will favour us with a reply. They are these. If he is allowed as an official, will he tell us what measures are in prospect at present for dealing with this remarkable and apparently increasing difficulty of getting enough water for Egypt other than by the raising of the Assuan dam. Of course, the difficulty largely arises, as Captain Lyons has shown us, from the changed conditions of agriculture, particularly from the increase of cotton-planting. It is a remarkable fact that in Roman times they were apparently able to get sufficient water, and that the difficulty which has existed now for several generations, the difficulty caused by the existence of great wastes of land in the delta of the Nile, did not exist then. If you travel in certain parts of this delta to-day, you will see that vines and olive trees were cultivated in Roman times; now that country is perfectly incapable of growing either of those plants. This is due partly perhaps to the fact that the delta of the Nile is experiencing periodic or continuous subsidence. But, whether or no, the ancients at a certain period were able, apparently, to irrigate the delta of the Nile sufficiently to supplement the periodical rainfall. What I would ask Captain Lyons to tell is, whether any measures are in prospect in the immediate future for dealing with the difficulty of the Bahr-el-Jebel marshes —for reducing their area and for preventing the Sobat waters from ponding back? I suppose no measures could be taken for lessening the seepage from the middle course of the Nile between Abu Hamed and the second cataract. So long as the Earth is made as it is at present, and we have those remarkable depressions on the west of the Nile, there will be a constant leakage of water. In general, will he tell us whether the Egyptian Government sees its way, in connection with the Sudan Government, to dealing with those problems in so far as the country above the dam is concerned? I gather (it is a new fact to me) that the official explanation of the remarkable series of low Niles, which we have had now for a good many years, is that there were, in each of these years, certain meteorological conditions which caused an interruption of the Abyssinian rainfall for a certain time, and lowered the amount of water discharged into the river by about one-tenth. It is a very remarkable run of bad luck, and perhaps Captain Lyons can find time to explain to us how this unfortunate condition of things has occurred, that, for some six or seven years, the Nile has constantly fallen below what is considered an average flood, with the exception, of course, of last year, when the deficiency was made up by an unusually late series of storms. I think, in asking those questions, I am perhaps rendering the meeting the only service of which I am capable.

Dr. STRAHAN: It has occurred to me, and I dare say to others in this room, during the course of the evening, to reflect upon the extraordinary advances in our knowledge of the valley of the Nile which have been made within our own lifetime. I have a recollection of this region as being wrapt in mystery, an unknown land; now we are told of the rainfall, the river-system, and of many details connected with them. This result is largely due, of course, to those pioneers in geography

many of whom have placed their observations before this Society, but we owe it in no small degree to the staff over which Captain Lyons so ably presides. The Nile, though not unique, is peculiar in this respect—that it derives the whole of its waters from certain definable areas in the upper parts of its basin, and that for a great part of its course it acts merely as a conduit. I suppose that a very large part of the water is lost by evaporation. It had appeared to me likely that the effect of the marshes bordering the river would be much the same as that of a lake, and would tend to equalize the flow. By clearing the channel the height and rapidity of floods would be increased, as has happened in the case of several of our own rivers, by the removal of woods and the cutting of land-drains. But in Egypt the enormous evaporation has to be considered, and it seems to be doubtful whether any considerable proportion of the water which strays into the marshes ever gets back into the channel. I should like to ask a little further information from Captain Lyons on that question. Another point that struck me was the suggestion that the remarkably small gradient of part of the Nile valley is due to earth-movement. It seems rather a large demand to make upon our belief that the crust of the Earth had bent and produced this effect, rather than that it was due to unequal erosion of rocks differing in hardness; but if we consider the configuration of that part of Africa, we shall see that the suggestion is not so wild as might appear at first sight. What, for example, is the meaning of the course pursued by the Nile, and of that remarkable gulf the Red sea? How did that gulf get there, and why did the river pursue a course roughly parallel to it, if it were not by a lowering and upheaving of the Earth's crust? Moreover, there is geological evidence that such movements have taken place. We have the remarkable depression of the Jordan and the Dead sea, with a possible further extension. We have also various rift-valleys, to which a similar origin is attributed, in neighbouring parts of Africa. We have, in fact, reason to believe that in that part of the world much of the configuration is directly due to recent movements of the Earth's crust. This is a question perhaps rather apart from the main subject of the lecture to-night, but it is one with which Captain Lyons is most fully qualified to deal. I think, in conclusion, sir, I may say that I know of no region on the face of the Earth in which geographical exploration has yielded results of greater scientific value or economic importance than in the valley of the Nile.

Sir Charles Watson: Captain Lyons' paper has dealt with so many interesting facts that it is very difficult to know what to select to speak upon; but for my own part I enjoyed the paper very much, because it brought back to my mind days over thirty years ago when I was serving with the late General Gordon in the Sudan, and was making a sketch survey of those districts of which he showed us some excellent photographs. I think one of the most interesting points to which he alluded is the very curious course that the Nile has followed. If you look where it passes through the marsh region you will see that in place of going direct for the mouth of the Sobat, it takes a long bend to the west, thereby making the river longer than appears to be necessary. Then, when it comes to Khartum, in place of crossing the desert to Debbeh, it goes out of its way through the range of hills at Shabluka, when, under ordinary circumstances, you would think it would avoid that course. Then when it comes to Abu Hamed, in place of going across to Korosko, though there was not very much difficulty for the Nile to have taken that course, because it is a pretty good slope the whole way down, it takes a turn right round as you see to the south-west, and then turns again, so that the total distance that the Nile takes from Khartum to Assuan is, I believe, rather more than double the distance that it need have taken if it went in a straight line. This is very curious, and the only thing I can attribute it to is that it is a dispensation of

Providence to hold back the waters of the river and prevent them from flowing down too quickly into Egypt; in fact, it forms a series of what you may call "natural obstructions," which now the authorities in Egypt are trying to supplement by artificial dams. I hope that they will not interfere too much with the course of nature. After all, nature works very well for the benefit of man, and perhaps sometimes, with the science of modern days, we may be inclined to go a little too far in getting the better of nature. There is only one other point. It is one of great interest, and that is the system of land-measurement in Egypt. Captain Lyons has pointed out how the basis of land measures was a strip of land 100 cubits long and a cubit wide, and we should remember that that strip series of measurement of land, if we may use the expression, is not only to be found in Egypt, but also in this country, because the British system of measurement of land from the Saxon times is based upon the strip system. In this country the base strip was 440 cubits long and eleven cubits wide, and any one who has studied the Domesday Book will find that here our lands were divided exactly in the same way as Captain Lyons has pointed out the lands of the present day are divided in Egypt. Of course, we have planted hedges, and so forth, but looking at an Egyptian map, we see much the condition of things that existed in England a thousand years ago. I hope, sir, I have not been too long, and I can only say that I have heard with the greatest pleasure the paper by Captain Lyons, and I am sure we shall all profit by it.

The PRESIDENT: I am quite sure that any one who has even superficially studied Egyptian hydrography must see how important are the problems with which we are dealing to-night, for there is no other country on the face of the Earth but Egypt which is absolutely dependent for its very existence on the bounty of one river. The belief in the exceptional nature of these problems must have been increased by the interesting paper we have just listened to, and also by the discussion. I do not intend, not being an expert, to continue the discussion. I have, it is true, at times wondered whether it was not possible to use the huge equatorial lakes as great reservoirs, and thus get an ample supply of water for Egypt. I presume that this is impossible for two reasons. In the first place, I imagine the engineering difficulty connected with making a dam, enabling a sufficient quantity of water to be drawn off, may be insuperable; and, even if this is not the case, that the effect of using those lakes as reservoirs would merely be to fill up the marshes, and in the end very little good would result to Egypt itself. I merely rise, in your name, as I am quite sure I may, to express not only our thanks to the lecturer for his lecture, but to encourage him in every possible way to proceed in his admirable series of investigations. No man can possibly predict how much the future prosperity of Egypt depends on the scientific investigations of to-day.

Mr. BURGESS: I should like to ask one question with regard to those diagrams which Captain Lyons showed us, and that is, if he would explain why those depressions which occurred in such regularity, I suppose on the western bank of the Nile, were always on the one side of the river, and not on the other?

Captain LYONS: I will very briefly reply, so far as in my power, to the points that have been raised. Regarding the long and narrow holdings, Sir George Darwin referred to, it is the predominant form of holding in Egypt. It is a very usual form of land-holding—the long plough furrow, of narrow width, but there is an additional reason in Egypt because of the necessity for each landowner to have a portion of his land on the supplying water-channel, and naturally, with very long and narrow holdings, more landowners will have a frontage on the water-channel. Mr. Hogarth asked about the steps which were being taken to obtain

a larger water-supply. That falls in the province of the Sudan Irrigation Service, which has been, and is still, at work, collecting and compiling information on the plains of the Sudan, and also in the investigation of the country bordering the rivers. The marshes of the Bahr el Jebel have been largely surveyed, and the area of those marshes is found to be less than was at one time believed. The water that leaves the river by seepage is not altogether lost, for a part of that which at high flood has soaked into the alluvial plain through which the river flows, returns at the lowest stage when the level of the river has fallen below that of the water-level in the flood-plain. I can only refer very briefly to the low floods of recent years, for the matter is part and parcel of the whole Indian ocean monsoon, and I am afraid it is too late to go into the matter this evening. It is a very big meteorological question, at which the meteorologists of India and Australia are steadily working, and to which we in Egypt are endeavouring to contribute. Of the water that goes on to the flood-plains of the Bahr el Jebel, which are largely occupied by lagoons and other depressions, but little can return to the river, since at the lowest stage 21,000 cubic feet per second is passing Gondokoro, and only about 12,000 reaches Lake No at the lower end, so at the lowest stage there is a loss of over 40 per cent. Sir Charles Watson referred to his survey of that river in 1874, a survey that was most useful to me when I was making one in 1901 and 1903, for it enabled me to compare the river's course at an interval of about thirty years, and it afforded very valuable evidence that so far from being a very unstable stream, to all intents and purposes the channel had not greatly altered. The reason of the great bends of the Nile is an interesting question, and one which will not, I am afraid, be solved for some time. The solution of it must depend largely on geological evidence. I believe that we have in the Nile course of to-day a collection of drainage systems from which the present single system with its peculiarities has been developed. As to the depressions on one side of the Nile only, I am afraid that is due to the point at which the section has been taken. Thank you very much for the very kind way in which you have received my paper.

THE FIRST CIRCUIT ROUND AFRICA, AND THE SUPPOSED RECORD OF IT.*

By Prof. W. M. FLINDERS PETRIE, D.C.L., LL.D., F.R.S., M.B.A.

THE French Academy of Inscriptions and Belles Lettres has recently received communications from M. Moret and Dr. Capart on monuments which, if genuine, would have been of the highest interest; but it is now believed that they rather have the interest of one of the most skilful forgeries that has yet come to light. The original inscriptions are engraved upon large figures of the Egyptian scarabæus. Such a vehicle for historical records in Egypt is already familiar. The present examples are later than others, larger, carved in limestone, and but roughly shaped on the back. In these points they are peculiar, but

* Although the inscriptions on these scarabs have been thoroughly discredited, it seems desirable to place the facts on record.—ED. *G. J.*

these are not grounds for doubting their genuineness. The lesser scarab measures 8 inches by $5\frac{1}{4}$ inches, and bears fifteen lines of hieroglyphic inscription; the greater scarab measures 8 inches by $6\frac{1}{5}$ inches,

THE LESSER SCARAB.

and bears fifteen lines of inscription. Both are dated from the twelfth year of Pharaoh Necho, 599 B.C. The inscriptions are translated by Dr. Capart as follow :—

Lesser Scarab.

"Year . . . . under the majesty of the Horus Saa-ab, lord of the two crowns Maa-kheru, the Golden Horus loved by the Gods, King of the South and the North, UAHEM-AB-RI, Son of the Sun, NEKAU who gives life like the Sun eternally, loved by the goddess Bast the great, mistress of Bubastis, eye of Ri master of Heaven, mistress of all the gods. . . . This day came one to tell his majesty 'Behold the envoy which thou hast sent to make the circuit of the hidden land has landed on the shore of Egypt. He comes in peace to report to his Majesty on what he has done since he left this land.' His Majesty said, 'Hasten to bring him to me.' This envoy came to the place where his Majesty was, he smelt the ground before his Majesty, and he told him all the marvels which happened to him while he went round this land in all its circuit. His Majesty commanded an account to be made of all the things that he had seen. Never was such a thing seen before. His Majesty presented many tributes brought from these countries to his mother the goddess Bast, mistress of Bubastis, eye of Ri. . . ."

Greater Scarab.

"The hereditary prince, the royal seal bearer, the lordly companion beloved, lord under the king of Upper Egypt, chief under the king of Lower Egypt, the great chief of the waterways, head of the fleet of Pharaoh, Peduneit. He says, 'I, the royal envoy, navigated in the great sea for his master. I was ordered by his Majesty to open the ways to the lands which were unknown to those who were before. In the year VIII, Phamenoth the 24th, I took the good way to the land of Ta-nuter. I landed in peace at the land of Punt in Pachons (day?). I arrived at the sea on the eleventh day. I went on in sailing south, navigating month after month to the south for the space of a year and seven months. I arrived at the "horn of the earth." I left the land of the living. Never knew I what place I existed in. I navigated many days after this, lacking my heart. I ended at the land of Egypt. I came in peace with very much tribute. I landed at Bubastis in satisfaction of heart in year XII, Paophi the 5th, under the Majesty of the king of Upper and Lower Egypt, UAHEM-AB-RI, Son of the Sun, NEKAU, who gives life eternally.' Never a like thing has been done before by any royal envoy. His Majesty ordered an account to be written of all the things seen by the royal envoy in his going round this land in all its circuit. And this monument remains on a royal decree in the temple of (Bubastis?) to proclaim his name on earth eternally for ever."

The essential facts of these documents, from a geographical point of view, are that Peduneit, an Egyptian admiral, set sail on August 13, 603 B.C.; went down the Red sea to about Aden or Somaliland, by about October 1, 603; stayed there eleven days; went on south month after month for nineteen months till May, 601 B.C., when he reached the

tip of the world; then, passing the desolate western deserts, he came back round the circuit of Africa in twenty-one months more to Egypt by February 27, 599 B.C. This implies sailing about 30 miles a day

THE GREATER SCARAB.

down the Red Sea, 8½ miles a day down the east coast, and 14½ miles a day up the west coast and Mediterranean.

Naturally we compare the report given by Herodotus (iv. 43). "Libya shows itself to be surrounded by water, except so much of it as borders upon Asia. Neko, king of Egypt, was the first whom we know of that proved this; he, when he had ceased digging the canal leading from the Nile to the Arabian gulf, sent certain Phœnicians in ships, with orders to sail back through the Pillars of Hercules into the northern sea (Mediterranean) and so to return to Egypt. The Phœnicians accordingly, setting out from the Red sea, navigated the southern sea; when autumn came, they went ashore, and sowed the land, by whatever part of Libya they happened to be sailing, and waited for harvest; then having reaped the corn, they put to sea again. When two years had thus passed, in the third, having doubled the Pillars of Hercules, they arrived in Egypt, and related what to me does not seem credible, but may to others, that as they sailed round Libya, they had the sun on their right hand." The date of the voyage, after the making of the Nile-Suez canal, agrees to the eighth year of the inscription. The direction also agrees. The command being given to Phœnicians, seems at first contradicted by the Egyptian name of the admiral, Peduneit (the gift of Neith). But Egyptian names were commonly taken by foreign officers in the service; and there is preserved in the Cairo museum a statuette of Neith dedicated by a Peduneit, with a Karian inscription, proving that a foreigner of importance took the name of Peduneit sometime during the previous reign. This may well be the foreign or Phœnician admiral of Herodotus. The account of settling for cultivation each year agrees to the general rate of sailing, being only a third or a half of the rate recorded at the beginning of the voyage. The only discrepancy is in the statement of under three years being occupied instead of three and a half years in the inscription. This statement comes immediately after the record of harvesting, and was a slight slip in attributing the number of harvests to the whole length of the voyage. The vessel must have carried a year's grain, to last from one harvest to the next. The stores would be filled up in October, 603, at Punt; the first harvest would be on the east coast about the autumn of 602; passing the Cape in May, 601, the second harvest would be on the west coast about the end of 601; then the Mediterranean would be reached in the latter part of 600, as they landed in Egypt by February 27, 599. Hence the ample supplies of Spain would obviate the need of waiting for a third harvest at the end of 600 B.C. The account of two harvests, "when two years had thus passed" in cultivation, exactly agrees with the contemporary inscription.

So far we see that there is no ground for doubting these scarabs on their internal evidence. But the vast stores of references collected for the new hieroglyphic dictionary at Berlin have enabled the construction of the documents to be tracked. They are found to consist of many

passages identical with those in published inscriptions, connected by other unknown passages. The grammar and usage of words is in many cases unusual and faulty, judging from common usage. Now, all this might occur in any inscription, or a modern letter; but the serious fact is that all the apparent faults occur in the connecting passages which are without a published source. This marked difference of correctness between the parts which have a precedent and those which are without precedent, appears to make evident their nature as a modern forgery. And it is stated that the material is lithographic and not Egyptian limestone. Yet the fabrication is marvellously good; the hieroglyphics are beautifully cut, true to the style of the period named, and they show a better appreciation of the forms than is to be found in any usual copies by scholars.

The surrounding facts are that the scarabs were sold by the widow of the late Egyptologist M. Bouriant, formerly head of the French School in Egypt, as having been bought by him. He died in 1902, but one of the parallel inscriptions was not published till 1906. All the published parallels are in French works. So long as the presumption is that these are of modern make, a doubt will hang over many inscriptions that may come forward without a clear history of their discovery. The authentication obtained by regular excavation is more necessary now than ever before.

THE SWEDISH MAGELLANIAN EXPEDITION, 1907-1909: PRELIMINARY REPORTS.*

By CARL SCOTTSBERG, D.Sc., Leader of the Expedition.

III. A Survey of the Great Otway and Skyring Waters.

Only a few years ago, the largest part of what is to-day known as the western continuation of Skyring water was a *terra incognita*. The Swedish Antarctic Expedition once intended to visit the place; this, however, became impossible. Long ago the Chilean Government had started a geographical survey in order to get a complete sea-chart, but the Peruvian war in 1878 postponed the work, and only a short time ago the map was published. The work yielded good results: Captain Gajardo discovered the narrow channel now bearing his name, and uniting Skyring with the Xaultegua gulf, a geographical discovery of very great importance.

No naturalists, however, formed part of the Chilean survey, and it is quite natural that Otway and Skyring channel should highly attract the attention of our expedition. Thus we felt very happy when the

* See *Geographical Journal*, vol. 31, p. 640.

Chilean Government offered us the *Huemul* once more, with coal and provisions for the voyage.

We left Punta Arenas on April 11, 1908, and entered Otway water through the Jerome channel. After having visited several places there, we made for the Fitzroy channel, the connection—and a very narrow one indeed—between Otway and Skyring. In Skyring many of the inlets were visited, as well as the Gajardo channel; this not being navigable except with small boats, we had to return the same way. On our way back we had the misfortune to break the propellor shaft; as it was in the narrow Jerome channel, on a pitch-dark night and with a strong current, our situation looked rather awkward at first. We managed, however, to anchor in a very little-known bay, Bahia Arauz, repaired the shaft provisionally, and reached Punta Arenas without further adventure on May 4.

From the geographical point of view, a journey through Otway and Skyring offers a great deal of interest. One has there an almost unique opportunity of studying the landscape, from the flat pampa round Fitzroy channel to the high cordillera in West Skyring, and a geologist as well as a botanist can never get a more satisfactory section through the east part of the great mountain chain than here. West Skyring is of much the same nature as the Patagonian channels—narrow inlets with steep shores cut deep in the bed, and in the south-west splendid glaciers reach the level of the sea. These narrow inlets are remarkable, their entrance being narrow and shallow, from a barrier of rock covered more or less with morainic deposits, which makes it impossible to cross but with small boats. On the other side of the barrier deep water is found once more. Thus these inlets may be considered as true fiords, their origin probably offering the same problems as the famous Norwegian fiords. In one case the isolation of the inner part had gone so far that this part (several miles in length) had fresh water; this is the Glacier sound (*Estero de los Ventisqueros*), where an extensive glacier comes down from the ice and snow fields in the interior of the Muñoz Gamero peninsula. The Gajardo channel is no exception to the rule; it also has a narrow part, with very little water. The tide runs here at least 8 miles, forming tremendous rapids round the rocks and boulders. We passed in a boat with great difficulty, and not at all without danger.

The mention of Gajardo channel makes me say a few words about the hydrography of Skyring. Fitzroy and Gajardo channels are the only and very narrow connections between other waters and Skyring, which has an abundant supply of fresh water in the form of ice and rain. The tide does not turn at the same time in Fitzroy and in Gajardo, being three hours later at the latter, according to information I have got. Subsequently Skyring has brackish water and almost no tides, the largest difference observed between high and low water

being only 15 centimetres. As our expedition is not provided with instruments for hydrographical work, I am only able to make these few remarks on a subject of such interest that it would be well worthy of a separate investigation.

From time to time Skyring is visited by the canoe Indians from the Patagonian channels. We found the skeletons of their native huts on many places, but never met them. Later I got to know that they came there later in the year, in June or July. Skyring water, where the shells are small and scarce, and the tidal region with rich supplies of food wanting, can never be of any importance for the Indians. To judge from the shells found round the camping-places, they carry provisions with them.

It was very interesting indeed to find the track they follow when they go to Skyring. They come from Obstruction sound, an inlet separated from Skyring by a narrow isthmus. On this isthmus there are two or probably three small lagoons, intersected by narrow strips of land. In Skyring, the road—we are right in calling it so—ends in Excelsior sound, from which we followed it up to the first lagoon. So well was it hidden that we could hardly find the entrance. It is cut through the forest in a deep and narrow *quebrada*, and its whole length —about 1100 feet—is laid with small sticks at a distance of 3 to 4 feet from each other, thus making it possible to drag the heavy canoes along.

Geology.—The petrographer, Mr. P. D. Quensel, as well as the palæontologist, Mr. J. Halle, had both a vast field for their work. Here I only quote the following short remarks:—

"Otway and Skyring both offer a splendid opportunity for getting a geological section from the Pampa, with its Tertiary horizontal beds, to the Cordillera with its disturbed and folded layers and eruptive rocks. The same series of porphyries, found before on the north side of the Azopardo valley, was also met with here in the crystalline state. In the Cordillera Pinto I discovered a remarkable rock of foyaïtic nature" (Quensel). "The Tertiary beds in the east are richly fossiliferous. At Mina Marta and Mina Magdalena I made very good collections of Tertiary plants, partially the same as near Rio de los Minas near Punta Arenas, partially new and probably undescribed. They occur in connection with lignite-beds. Farther to the west, on the line Puerto Altamirano—Punta Rocallosa, appear the Cretaceous somewhat disturbed layers not known before from this part, and containing many fossil marine animals, mostly Gastropoda" (Halle).

Botany.—As showing all the transitions between the treeless pampa and the typical rain-forest, Otway and Skyring are of great advantage for phytogeographical studies. From the west to the east it is possible to distinguish the following types: (1) *Nothofagus-bituloides* forest (typical rain-forest); (2) a mixed forest of this species and *N. pumilio;* (3) *N. pumilio* forest; (4) *N. antarctica* forest; (5) Steppe.

In Skyring and Otway various important plants reach their southern limit, as, *e.g.*, *Pseudopanax lætevirens*, *Tepualia stipularis*, *Gunnera chilensis* (the famous giant "pangue"), and *Dacrydium Jonkii*.

Of a certain importance was the survey of the vegetation in the vicinity of the great glaciers. Close to the ice grows quite a number of alpine plants, at the very sea-level, and the first arboreous vegetation is represented by *Nothofagus antarctica*, the same species that constitutes the forest at its vertical limit on the mountain-slopes.

That the peculiar conditions in Skyring water should act upon the constitution of the marine flora, seems quite natural. Already in Otway one notes a certain poverty in species, but the flora there is rich in comparison with that of Skyring. As there are practically no tides, the littoral flora is exceedingly poor. And the freshness of the water has made the sublittoral *Macrocystis* formation disappear, an association that otherwise never seems to lack round subantarctic shores. The most common aquatic plant in Skyring is a *Ruppia*, forming extensive submarine meadows.

In Fitzroy channel, as well as in Gajàrdo channel, the typical algæ reappear, the Corallinaceæ again cover the stones, and the great kelp floats along on the surface.

Zoology.—The influence of the brackish water in Skyring upon the fauna is easy to recognize. Almost all the characteristic and common Magellanic creatures have disappeared. But one need not go farther than the Fitzroy channel, and the dredge will bring up a rich harvest.

THE UGANDA-CONGO BOUNDARY COMMISSION.*

Summary Report.

By Major R. G. T. BRIGHT, C.M.G.

During the work of the British Section of the recent Anglo-Congolese Boundary Commission for the survey of the country on the western border of the Uganda Protectorate, a survey was completed of the country in the vicinity of the 30th meridian east of Greenwich from lat. S. 1°, and extending westwards to the river Ruchuro, to nearly the second parallel of north latitude. The eastern shore of Lake Albert Edward and the whole of its north-easterly arm, called on maps Lake Ruisamba or Dweru, was mapped. The river Semliki was followed throughout its course from Lake Albert Edward to Lake Albert. All the eastern shore of the latter up to the Victoria Nile was surveyed, and a great portion also of its opposite side.

* At one of the meetings during the new session Major Bright will give a full account of the results of this expedition, which will be accompanied by a map.

As much as possible was done to delineate the features of Mount Ruwenzori, and it may be said that it was mapped up to its snow-line. Higher than that it was not considered necessary to go, nor would it have been practicable to survey in the snow-covered regions without special equipment. But little of the country passed through can be said to be absolutely unknown. Various explorers have travelled through it and made maps, though but only two can be said to have done really accurate surveys, and these are His Royal Highness the Duke of the Abruzzi on Ruwenzori and Captain T. T. Behrens, Royal Engineers, who, during the Anglo-German Boundary Commission in Uganda, made a map of the eastern shore of Lake Albert Edward. The results obtained by the recent Boundary Commission agreed very closely with those obtained by these gentlemen.

The principal physical features of the country traversed by the commission, in addition to those previously mentioned, are the highlands of the western part of Ankoli, the arm of the great Ituri forest in the Semliki valley, the Bulegga uplands on the Nile-Congo watershed, the escarpment bordering the eastern shore of Lake Albert, and the Victoria Nile. Extending from a little north of lat. S. 1° to as far as can be seen southwards, is a wild mountainous country, the peaks of which range from 6000 to 8000 feet above mean sea-level. North of this region, though still keeping a highland character, it is open and less wooded. The soil appears to be rich and productive, and the climate is cool and healthy. It is here chiefly a pasture country, inhabited by Bahima.

The two lakes Albert Edward and Albert are very similar in surroundings and character. Each has the appearance of a shallow lake, occupying a portion of what must once have been its bed. In Chaangu, on the west of Lake Albert Edward, rises a range of mountains reaching over 8000 feet in height. The Semliki flows out of the north end of Lake Albert Edward, and is throughout its course a fine broad river varying from 60 to 100 yards in width. It is broken in places by cataracts and rapids. Its total fall is about 960 feet in its length of 155 miles, from 3000 feet, the height of Albert Edward, to 2037 feet, the level of Lake Albert. The eastern extremity of the great equatorial forest is often of the greatest density, though not always tropical in character. It extends unbroken from the higher slopes of Ruwenzori across the Semliki valley, and away to the west.

Lying between the Semliki valley and the plateau to the north of the Lake Albert Edward depression is the long ridge of Ruwenzori. The snow-peaks of Ruwenzori, which form such a striking and curious feature in close proximity to the equator, are comprised in an area of some 55 square miles in the central part of the mountain. They consist of three main groups or "massifs." North of these are two smaller peaks, and south is a chain of lower heights. The height obtained for

the summit was 16,794 feet, former heights being by H.R.H. The Duke of the Abruzzi, 16,815 feet, and by Captain Behrens, 16,618 feet. The snow-line in the valleys comes as low as 13,200 feet, but on the peaks it appears to be higher. No peak was observed of a less altitude than 14,700 feet that had snow on it, except occasionally and temporarily.

On the west of Lake Albert, the mountains, which rise to an altitude of 7000 feet and over, fall sheer into the water along its whole extent, save at the south end, where there is a plain between the lake and the hills. On the east of the lake is a similar steep escarpment, commencing from the northern slopes of Ruwenzori, and rising abruptly from the flat Semliki plains; this gradually diminishes, and, eventually leaving the Albert, terminates near the Victoria Nile.

On the west of the Semliki valley is the Nile-Congo watershed. Hills rise, forest-clad up to Mboga; north of that settlement, they become open grassland and are known as the Bulegga hills. This is a cool and pleasant district, fertile and inhabited by cattle-owning natives. From where the watershed approaches the lake (and it is within a few miles of it), it becomes, in that part which lies within the Uganda Protectorate, thinly populated and difficult for travelling.

But few portions of the country which was seen by the commission were uninhabited. In the southern regions (Ankoli) the population can be roughly classified as the Bahima, the aristocracy, and the Bæro, the cultivators and serfs. When the Galla invaders came down from the north they established a powerful branch of the Hamitic family in Ankoli. The Bæro, on the contrary, are a distinctly Bantu race. The fact that for years they have supplied the Bahima nobles with concubines has done much to spread the Galla blood, but still there can be no doubt that the Bæro are a negroid and inferior people. The hilly country to the south of Lake Albert Edward is tenanted by the Basiggi or Bachigga. This tribe is of Bæro stock, but of a lower degree of civilization. They have no chiefs, but manage their affairs by families. A sect of witch doctresses, which calls itself Niawingi, has obtained great influence in the more remote districts. This power is unfortunately hostile to European influence, and is mainly used to stir up strife.

The Semliki forest is inhabited by the Baamba, a Bantu race. This tribe is addicted to cannibalism, and constant warfare goes on between village and village. The Baamba, however, greatly fear the pygmies who live near them. These little people prey on the crops of their larger neighbours, but in return do them service when fighting or hunting. The Batwa or Bambutu inhabit the forest. They stand about 4 feet high, and are long-armed, short-legged, and ugly, being usually distinctly prognathous. They have no religion and no industries. No attempt is made to cultivate, but they depend entirely on game and what they can steal from their neighbours. The Banande appear to be related to the pygmies, but not of them. They are bigger and more

Simian in appearance. It seems that they are absolute pariahs, and are found hanging around the Baamba or Bavira villages, literally living on what they can pick up.

In the country between the Nile-Congo watershed and Lake Albert the inhabitants differ widely. The Balegga and Bavira are closely allied. Their physique is finer than the natives of either Ankoli or Toro; they belong to the Bantu race. Except that these natives occasionally spear or shoot a man, belonging to some other chief, with an arrow, they are a friendly and pleasant people. Their neighbours, the Lendu, are Nilotic. They are warlike, and are continually fighting with each other or any one else they think themselves strong enough to overcome. There is little intercourse between the Lendu and Balegga.

Generally speaking, the country passed is occupied by a mass of granite and gneiss and a series of crystalline rocks of indeterminate age, overlain in the sunken areas of Lake Albert Edward and the Semliki valley and in the depression containing the north-east extension of Lake Albert Edward by alluvium, and in four small detached districts by volcanic rocks. The high plateau to the east of Lake Albert Edward and Ruwenzori consists mainly of gneiss, with intercalations of schistose rocks of various kinds and bands of quartzite. The Bulegga plateau is a mass of granite, intersected by numerous basic dykes, and bordered on the south-east by a zone of gneissose and schistose rocks, with some accompanying fault-breccias, which afford evidence of the faulting and subsidence which have occurred there. The foothills of Ruwenzori consist similarly of quartzite, quartzose schists, sheared quartz-felspar rocks, and gneiss of various types, with intercalations of epidiorite and amphibolite schist, all dipping vertically and striking generally in the direction of the range. Volcanic rocks occur in the four districts of Kichwamba, Katwe, Kyatwa, and Fort Portal. A large quantity of salt is extracted by the natives from the Katwe salt lake. The salt seems to be derived from certain bands of tuff by percolating surface water, which rises as springs in the bed of the lake.

The open plains to the south of Lake Albert Edward were covered with game. Uganda cob (*C. Thomasi*) were found in great numbers. The river Ruchuro swarms with hippopotamuses, which are left severely alone by the natives, though in the river they might be attacked with little or no danger. A curious feature of the Albert Edward is the great number of dead fish that are found floating on the surface. The natives say that they die from bad water. This lake is usually supposed to be quite free from crocodiles. The country between the Congolese stations Kasindi and Beni is an ideal elephant country, and is tenanted by some large herds. In the thick forest west of the Semliki valley elephant and buffalo were plentiful, but, excepting parrots, there was very little bird-life. On the Congo-Nile watershed in the neighbourhood of Lake Albert there is practically no animal-life. A small herd

of red Congo buffalo (*Bos Caffer Nanus*) was seen in the Semliki forest.

Throughout the commission, with the exception of the north-easterly shore of Lake Albert, no cases of sleeping sickness were seen. Unfortunately, this is no guarantee that the country will continue free from the disease. Tsetse-fly belts are common along the lake-shores, wherever bush comes near the water's edge and spreads up the banks of the streams flowing into the lakes.

The staff of the British section were: Major (temporary Lieut.-Colonel) R. G. T. Bright, C.M.G., Rifle Brigade; Captain E. M. Jack, R.E.; Captain the Honble. F. Prittie, Rifle Brigade; Mr. C. Chevallier; and Captain A. MacGregor and Captain S. Iredell of the King's African Rifles, Mr. J. Coates, and Mr. G. McCaw, and four British non-commissioned officers.

The commission started triangulation from two points fixed by the Anglo-German Boundary Commission (Uganda). These positions were obtained by a continuous triangulation from Zanzibar, the longitude of that place having been determined by telegraph some years previously. In the British calculations Clarke's figure of the Earth was used. The main triangulation on the east followed generally the line of the 30th meridian, on the west it extended to the river Ruchuro and the east shore of Lake Albert Edward. It was extended eastward to include the north-east branch of that lake, and from there passed northwards round and across the northern slopes of Ruwenzori. From the neighbourhood of the northern shore of Lake Albert Edward, the triangulation was extended to the west of Ruwenzori, and closed with a point of the eastern triangulation on the northern spur. North of this junction it was continued to the Congo-Nile watershed; then north-eastwards along the western shore of Lake Albert nearly as far as lat. N. 2°. A rapid triangulation, connected with the main triangulation, was carried along the eastern shore of Lake Albert to the vicinity of the Victoria Nile.

During the work of the commission a scheme was prepared for the geodetic measurement of the 30th meridian, and when the actual survey of the boundary zone was completed, the measurement of the arc was commenced. The topography was carried out on the scale of 1 : 250,000. Plane-tables were used throughout, with Indian pattern clinometers, except in the dense forest, where traverses between fixed points were made with the prismatic compass. Over twenty prominent peaks of Ruwenzori were fixed trigonometrically, including eleven above the snow-line. Of these eight were previously mapped by H.R.H. The Duke of the Abruzzi, and the positions agreed closely with his. Two check-bases were measured. The Invar-Jäderin apparatus was used, this having been brought out for subsequent use on geodetic work. At two positions astronomical observations were also taken for latitude and azimuth. The results, though quite discordant with the triangulation

latitudes, are of scientific interest. The large mass of Ruwenzori is the cause of the local attraction, and is probably enough to account for the differences.

LEVELLING BETWEEN THE NILE AND CONGO BASINS.*

As was pointed out by Captain Behrens in his paper printed in the *Journal* for March, 1907, precise data for a knowledge of the altitudes of the lakes and other surface features of Equatorial Africa have been gradually accumulating within recent years, thanks to the careful observations carried out by various boundary or railway surveys. Some addition to our knowledge in this respect has been made by the surveys undertaken on behalf of the Congo State along the lines of projected railways in the region between the upper Nile and the Congo. Through the courtesy of M. Liebrechts, Secrétaire-Général du Département de l'Intérieur du Congo, copies of the maps showing the results of these surveys have been forwarded to us through Captain S. F. Newcombe, R.E., an officer in the service of the Sudan Government, who has accompanied them with some explanatory notes. The map given with the present number is a reduction from the Belgian maps.

It will be seen that three different lines of levels are included. The first of these, shown in the lower part of the sheet in sects. I.–III., runs along the western bank of the Nile from Dufile to Rejaf, connecting the navigable portions of the river above and below the rapids. The sheets of the Belgian map were plotted on the scale of 1 : 20,000, but this has been reduced in our map to that of 1 : 250,000. The two other lines are those from Stanleyville on the Congo to the Albert Nyanza *viâ* the upper Ituri, and from Tanganyika to the upper Ituri, connecting with the first. They are shown together on the main portion of the sheet, on the scale of 1 : 2,000,000, or half of that on which the original surveys were combined in the Belgian map sent to us. A note on this last explains that the separate sections were constructed on different magnetic meridians, but that in the absence of definite information as to the amount of declination in each case, the original orientation of each has been retained. In preparing the accompanying map the draughtsman has, however, adapted the separate sections of the traverse to positions taken from the best existing maps.

In the Belgian survey between the Congo and the Albert Nyanza the altitudes were referred to the starting-point at Stanleyville as a base. The altitude of this has been fixed instrumentally from the West Coast as 430 metres, or 1351 feet, and on this basis the altitude of the Albert lake is given by the Belgian survey as 639 metres, or 2096 feet. This figure differs by 59 feet from that adopted at the

* Map, p. 548.

British War Office on the basis of levelling from the east, to which reference has already been made in the *Journal* (vol. **30**, p. 219; vol. **32**, p. 85). It has therefore seemed best (in the absence of information respecting the degree of precision attaching to the determination of the altitude of Stanleyville) to accept the British value in the case of Lake Albert,* and to apply a constant correction of −59 feet to the Belgian values along the line from Stanleyville to that lake. In the case of the line to Tanganyika, the Belgian traverse gives the difference of level between this lake and the Albert Nyanza as 171 metres, or 561 feet, the altitude of Tanganyika appearing as 810 metres, or 2658 feet, which, on the basis of the English value for the height of the Albert lake, will be reduced to 2599 feet. But, as Captain Behrens has shown (*Journal*, vol. **29**, p. 213), the trigonometrically determined height of Tanganyika is 2624 feet; this figure has therefore been adopted in our map, the required correction being distributed proportionally over the various stations between that lake and the junction with the Stanleyville—Lake Albert line. Unfortunately, the surveyors do not appear to have connected their line of levels with the surfaces of Lakes Kivu and Albert Edward, the heights of which have therefore been supplied from Captain Behrens' figures.

As regards the line from Dufile to Rejaf, it does not appear what base of reference has been used by the Belgian surveyors. We have therefore adjusted their figures to the altitude of Dufile as deduced from that of the Albert Nyanza (allowing for the probable slope of the intervening section of the Nile), and to the best available altitude of Rejaf. The Belgian surveyors also give a table showing the exact distribution of rapids and navigable water between Dufile and Rejaf, distinguishing also between lesser rapids and greater rapids and falls. Out of the whole distance of 173 kilometres (108 miles), 39 (24 miles) are taken up with lesser rapids (made up of twenty separate stretches of broken water) and 12 ($7\frac{1}{2}$ miles) of greater rapids and falls (in five different sections). The Congo Government use steel boats between Kaia and Rejaf, carrying 2 tons each. These pass through the formidable Bedden rapids.

Captain Newcombe points out that between Irumu and the Semliki, going south, the watershed appears to be very low, the highest point being shown as 1161 metres (3810 feet). The fall from this point to the Semliki cannot be exceptionally difficult. On the other hand, there is a fall to the Albert Nyanza near Mahagi from 2040 metres (6693 feet) to 639 metres (2096 feet). Up to Irumu the Ituri is obviously not steep, but north of that point the rivers descend rapidly.

* It may be well to point out that the altitude 2096 feet given in our map for a point in the immediate neighbourhood of the Albert lake does not refer to the lake surface, although, by a pure coincidence, the figure is the same as that given by the Belgian traverse to the lake itself. The point is 59 feet above the lake, which happens to be exactly the amount of the correction above referred to.

FURTHER EXPLORATION IN THE HUNZA-NAGAR AND THE HISPAR GLACIER.*

By Mrs. FANNY BULLOCK WORKMAN.

Dr. Hunter Workman and myself, accompanied by Dr. C. Calciati and Dr. M. Koncza—former pupils of Prof. Jean Brunhes and graduates of the University of Fribourg, Switzerland—as topographers, Cyprian Savoye, guide of Courmayeur, and three Italian porters, have finished a very interesting visit to Hunzar-Nagar and the Hispar glacier. The object of the expedition, in particular, was to make a detailed survey of all the branches of this glacier, and explore them to their sources, this not having been done by Sir Martin Conway in his rapid ascent of the Hispar in 1892. Being favoured generally with very fine weather, this plan was to a large extent successfully accomplished.

Careful note was taken of Mr. H. Hayden's stations, on behalf of the Geological Survey, at the tongues of the Hassanabad, Tengutsa, and Hispar glaciers, changes noted and all observation-points including a number in addition to those of Mr. Hayden marked in red. Special attention was given to investigation of the Nuskik La as a practicable pass for a caravan to the Basha valley. Neither of the routes over it, drawn on Sir Martin Conway's map, are at present feasible for loaded coolies. The danger from avalanches is imminent at all hours of the day. Huge séracs, and above them overhanging cornices, give way constantly, crashing down upon the route to be taken. Starting very early with guide and porters only, we visited the col and climbed a snow-summit rising 1500 feet or more above it to the east. On reaching our base-camp afterwards, the guide remarked he was glad that that climb was over, and that he should not care to incur the risk a second time. Doubtless the snow conditions have greatly changed on the Hispar side in the last fifteen years. The ascent from the south, the Baltistan side, to the col is perfectly simple, as we saw from above the pass.

Much of topographical and glaciological interest was found on the ascents of the 12 and 15 mile long northern branches, the Gutun, Kanibasar, and the highest, most northern icy branch, which ascends on the Nagar side of the Hispar pass to a col of about 19,000 feet overlooking a large enclosed glacier. The topography of these was quite different from that shown on existing maps. We made a base-camp at a height of 16,000 feet for ten days on the final mountain-flank of right bank, at the base of the last sérac leading to the Hispar or Zong La. From here, ascending north-east over ice-falls, and for some miles over a wide snow plateau, and finally up a sheer 1000-feet snow-slant, we brought

* Dated "Skardu, September 10, 1908."

fifteen coolies and small camp to a snow-flat under a very sharp triangular snow-pyramid which crowns the watershed between the Hispar and Biafo glaciers. This camp was at over 19,000 feet. Our heights have not yet been finally calculated.

The next day, with guide and two porters, I ascended this peak, while Dr. Workman with a porter climbed a somewhat lower summit for photographic and observation purposes. The east arête of the higher peak, the Biafo watershed side, while less steep was so fluted with cornices that we dared not attempt it, so we climbed by the much sharper south one facing the Hispar, which was a risky, very abrupt knife-edge slant of over 2000 feet. By judicious step cutting we reached the tiny corniced top in safety. The view from this mountain is perhaps the most comprehensive and beautiful I have seen in the Himalayas. A page would not suffice to describe it, but in this note I will only say, that from its position high above Snow lake this summit, overlooking as it does the full sweeps of the Hispar and Biafo glaciers and the great peaks to the source of the Baltoro, may be said to include in its vista of a 60-mile range east and west a panorama of superlative grandeur of one of the most magnificent mountain regions of the world. We did not go to the Hispar glacier to indulge in high climbing, for the mountains are not suitable for such exploits, but I am glad I did not resist the sudden impulse to climb this peak, for I should have missed a rare hour of Himalayan mountain glory, and a view of topographical and geographical importance. The height of the mountain will probably work out at between 21,000 and 22,000 feet.

On August 16, with a caravan of Nagar coolies we crossed the Hispar pass to the Biafo glacier. The large glacier running from Snow lake south-east behind the B 15 range was investigated, and a passage looked for to the north of that range, which we hoped might lead to a possible route to the Punmah glacier, but the only available pass was found quite beyond the mountaineering capacity of loaded coolies. We descended the Biafo glacier, reaching Askole on August 25. This was our second visit to this glacier, the first having been made in 1899.

THE PORT OF MANCHESTER: THE INFLUENCE OF A GREAT CANAL.

By JOHN M'FARLANE, Lecturer in Geography at the University of Manchester.

THE present seems a suitable moment for reviewing the development of the port of Manchester, and for attempting to estimate the place which it holds as an importing and exporting centre. There is no doubt that the sanguine expectations of those who promoted the construction of the canal have not as yet been fulfilled. On the other hand, progress has been steady and continuous, and we would make our dominant note this—that the port of Manchester, because of its geographical

position and conditions, must continue to grow; that certain non-geographical factors which have so far retarded its growth will gradually become of less importance; and that for certain classes of goods, Manchester will eventually become the leading port in the kingdom. The Ship canal is one of the greatest geographical advantages which Manchester possesses. Its endowment in these, indeed, is not great. Temporary conditions connected with the cotton industry gave it considerable importance during the nineteenth century, but in the cotton industry the tendency was centrifugal rather than centripetal, and Manchester as a town was actually on the decline when the canal was constructed. Since then the decline has been checked and the movement reversed, while the surrounding country is gradually being more closely united to the city which is becoming its port.

The facility with which trade moves to a new port, however, varies with a number of considerations. The momentum which older ports have acquired, the organization of the traders in the commodities imported and exported, and the weight and bulk—as well as the value of these commodities—have all to be taken into account. To illustrate these factors in the development of a port and at the same time to obtain some idea of the hinterland of the port of Manchester, we propose to examine the conditions determining the distribution of some of the chief commodities introduced into the country by the Ship canal.

To Manchester people cotton is naturally the most interesting of these, and it illustrates very well some of the difficulties which prevent the rapid development of the port. At first sight it might appear that it would be through Manchester that the great bulk of the raw material required in the cotton industry would be introduced into the country. Within 12 miles of the docks more than 32 millions of the 44 millions of spindles in the United Kingdom are found, and to all the towns where these 32 millions are situated the rate for transmission of raw cotton by rail is less from Manchester than from Liverpool. To Bolton, for example, the rate including Ship canal toll and dock charges is 10*s.* per ton from Manchester, while the cost *viâ* Liverpool is 13*s.* 6*d.*—a difference of 3*s.* 6*d.* To Oldham the rate from Manchester is 9*s.* 9*d.*, while from Liverpool it is 14*s.* 8*d.*—a difference of 4*s.* 11*d.* To Stockport the charges are 8*s.* 10*d.* and 12*s.* 8*d.* respectfully, the difference being 3*s.* 10*d.* It is unnecessary to multiply examples. Without reflection, therefore, one might be led to suppose that the places to which cotton goes from Manchester, are the places to which the rates are less than from Liverpool. But such a supposition would be very wide of the mark. With nearly 75 per cent. of the spindles of the United Kingdom in its immediate neighbourhood, Manchester only imports about 14 per cent. of the raw material which is used, while Liverpool imports about five times as much. For this there are several reasons, the chief being of an economic nature. In the first place, there is the long-established supremacy of Liverpool as a great cotton market. That city thereby acquired a momentum which could not be seriously affected within the short period which has elapsed since the opening of the canal. At the beginning of that period, too, there was no cotton market in Manchester. The Manchester spinners had either to buy direct from the United States or go to Liverpool and buy in the market there. But there are great difficulties in buying direct from the States. Few spinners are able or willing to buy the year's supply at once. If it is bought in instalments it is impossible to ensure that the quality will be the same. When it is bought in Manchester through importers, the difficulties do not disappear. A comparatively small amount comes to this port, and although a spinner might be anxious to support the canal and at the same time effect a saving to his own pocket by purchasing in Manchester, he will frequently find either that there is no cotton on the wharf, or that it is not of the quality he requires. By going to Liverpool he is

able to obtain just what he wants. Now, although this difficulty might be got over by the establishment of a spot market in Manchester—and such a market has recently been started—a more serious obstacle has to be met. Much of the dealing in cotton is not for present, but for future delivery, and Liverpool merchants refuse to recognize the existence of Manchester. For example, if a dealer has one hundred bales of cotton in Manchester and sells them against futures held in Liverpool, they must be sent down to Liverpool. They are not tenderable in Manchester. The importer, therefore, who has sold futures to a Liverpool broker brings the cotton to that town, and from there it is distributed over the manufacturing area. Thus we have a case where geographical advantages and economic conditions stand in opposition, and it is interesting to speculate on the ultimate result. Its growth so far has been steady and considerable. As compared with 121,336 bales American cotton imported to Manchester during the season 1895–6, the quantity imported from America during the season 1907–8 amounted to 377,264 bales. The establishment of a spot market in Manchester will lead to an increase of buying in that town, and will encourage the American shipper to send his cotton there in the future to a greater extent than in the past. As the imports increase, Liverpool brokers will be forced to come to terms, and although buying and selling may continue to be done in Liverpool, much more of the actual commodity will find its way into the country by way of Manchester.

Egyptian cotton affords an interesting commentary on what had been said. Relatively a much larger amount of this goes to Manchester. One cause is that there is a good line of steamers carrying on the trade, but the chief reason is that many spinners, in order to get good cotton, buy at the beginning of the year. The Egyptian business also is simpler, and the larger houses of cotton merchants are chiefly in English hands, and are trustworthy. The spinner, therefore, has to buy early in order to get the quality which he wants, and having bought it he is sure of getting it. There is, thus, not the same reason for him going to Liverpool, and the raw cotton is brought to Manchester direct. At the present time one-half of the Egyptian cotton used in Lancashire mills is shipped to Manchester. During the season 1907–8 this amounted to 216,570 bales.

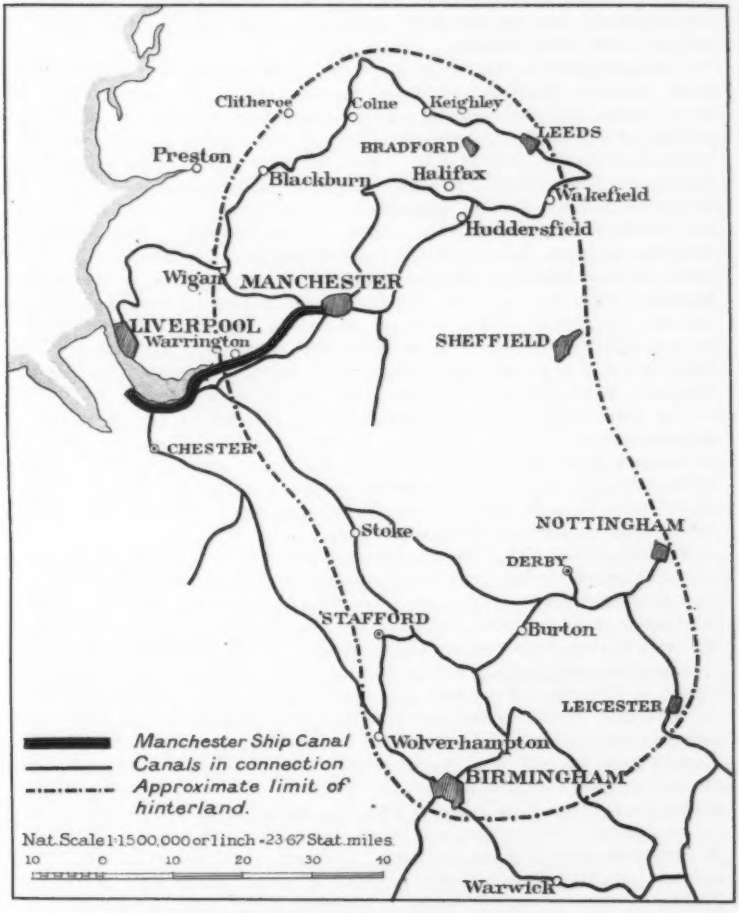
We have devoted rather more attention to cotton than we shall to the other imports of Manchester, even although cotton is not by weight the chief import, but it illustrates very well both the difficulties in determining the extent of the hinterland of the port under consideration, and the state of development in which that port at present is.

Timber is another of the chief articles of import to Manchester—by weight it is the most important. The Pennine chain forms practically the dividing line between the hinterland of Manchester and Hull for this commodity. To the east of the Pennines the greater part of the timber required in building, in the manufacture of packing-cases of all kinds, and for general purposes, consists of pine and firwood, which comes from Scandinavia and Russia—to the west of these mountains spruce and other woods from North America perform the same function, although some comes from the Baltic. The chief market for the buying and selling of timber is in Liverpool, but as it is one of these articles of which whole shiploads can be sent, the Liverpool importer frequently sends ships on to Manchester to unload. This wood is chiefly used in East Lancashire, where there is naturally a great demand. Some of it, however, does make its way as far east as Leeds and Bradford, while the market for it extends south as far as Nottingham, where the southern ports begin to compete with Manchester, which is now the eighth timber port in the United Kingdom.

Finer and harder woods, however, very seldom come to Manchester direct. These are not imported by the shipload, but in smaller quantities. The ships which bring them—say from South America—are generally Liverpool-bound

ships, and the value of the wood is such that it can easily stand the slight additional charge of carriage from that port.

During those years for which we have official figures, we find that the tonnage of raw materials used in the manufacture of paper ranks third in the list of imports by way of Manchester, and no inconsiderable part of the whole of our imports of wood pulp comes up the Ship canal. In England, paper mills are found chiefly in



HINTERLAND OF THE MANCHESTER CANAL.

Lancashire, in the West Riding of Yorkshire, and within a radius of thirty to forty miles of London, the first and the last being the districts in which the number of mills is greatest. In Lancashire the mills are concentrated, roughly speaking, within a triangular area, formed by joining together Liverpool, Manchester, and Blackburn; and, for the greater part of this region, Manchester is the port for wood pulp.

Round Blackburn and Darwen, however, the paper establishments are served chiefly by Preston; and Liverpool serves a certain part of the area contiguous to itself. But Manchester—by having rails running along the docks—is able to dispense with the additional cost of cartage from docks to railway station, and has in this way obtained a considerable hold of the trade. As far as we have been able to discover, comparatively little goes from Manchester into the West Riding. Hull seems to be the chief port for wood pulp for the country east of the Pennines. A certain amount, however, goes from Liverpool to Leeds and Worcester, probably making its way there by canal.

The grain trade of Manchester has developed very considerably within recent years. In 1895, 35,000 tons came up the canal, and in 1907 this had risen to 406,000 tons. Manchester, during the last three years, has received on an average one-fifth of the amount received by Liverpool, and somewhat more than one-twentieth of the total imports of the United Kingdom. Grain comes chiefly from the Atlantic wheat ports of North and South America, Russia, and India. So far as we have been able to discover there are no special circumstances affecting the area over which it is distributed. The number of boats bringing it being limited, it frequently happens, however, that it is introduced into this area through other ports. Local variations in price also lead to its being sent to towns on the margin, sometimes from one port and sometimes from another. Generally speaking, however, the region served—but not exclusively by Manchester—is somewhat as follows. To the west of Manchester as far as Warrington and the mills on the Weaver; northwards for about 20 miles, but certainly not beyond Blackburn, where Fleetwood competes; eastwards as far as Leeds, to which the rate is just a little more than from Hull (6*s.* 10*d.* and 6*s.* 3*d.* respectively); and southwards for about 100 miles. Leicester and Birmingham, for example, are more cheaply supplied from Manchester than from Liverpool or Hull, but are able to take advantage of the competition of the southern ports. The percentage which comes through Manchester of the total supply of different parts of the district we have, however, been unable to learn.

Fruit imports of Manchester are considerable, and as the area over which they are distributed varies from the area of distribution of other imports, a few words on the subject may not be out of place. The West Mediterranean, the West Indies, and Canada, and the United States, are the chief sources of supply. The trade from each of these illustrates the way in which a new port develops. Before the opening of the canal, and still so to a large extent, the fruit-importing business was centred in Liverpool. Manchester fruit merchants saw that if they were to reap the advantages created by the new port they would have to become their own importers, and the North of England Fruit Brokers Company, Limited, was formed. That company has established regular sailings with the West Mediterranean, and the fruit which is imported finds its way northward as far as Blackburn, into the western towns of the West Riding of Yorkshire, *e.g.* to Sheffield, and southward as far as Leicester, Nottingham, and Birmingham. But with regard to the East Mediterranean its trade is less important. There are several reasons for this. The company is hardly sufficiently strong to maintain regular sailings with the *Levant*. They are dependant on, say, cotton vessels from Egypt bringing parts of their produce, and a fall in the price of cotton in England may delay the sailing of a ship for a few days, with the result that damage to the fruit cargo ensues. They are, perhaps, also not sufficiently strong to meet the occasional losses sustained by those engaged in trade with the somewhat unscrupulous Levantines.

The banana trade with the West Indies and Costa Rica offers an interesting contrast. This was established after the opening of the canal, and Manchester

was fixed upon as the port of entry, because of its nearness to the source of supply on the one hand, and to a large consuming area on the other. The facilities offered by excellent warehousing accommodation and railway distribution were also important factors in determining its selection for this purpose. The whole of the bananas shipped from the West Indies and Costa Rica are landed at Manchester and Bristol, the former receiving about two-thirds of the whole, or 60,000 bunches per week. The business is in the hands of one firm, and the country is practically divided into two parts. Bristol serves the south of England, Birmingham, and London in part; Manchester serves the rest of the country, a great part of the Birmingham area, and London in part. From Manchester also bananas are sent packed in special vans to Ireland, to Hamburg, and to the Baltic countries. In this case, therefore, we have an industry able, because it is in the hands of one firm and free from complications, to avail itself of the geographical advantages of the new port.

The trade with Canada and the United States in apples is growing. Hitherto it has been somewhat handicapped by the want of more frequent sailings, but this season the Manchester Liners, Ltd., have increased their Montreal service to weekly sailings, and this will doubtless lead to an increased supply. The area of distribution is much as we have already sketched for West Mediterranean products, though American apples find their way as far as Gloucester, and occasionally—but only occasionally—to Newcastle.

The oil trade of the country is very largely in the hands of the Standard Oil Company, and may be divided roughly into that in lubricating oils, and that in illuminating oils. With regard to the first, the distribution is made from the quays, and it is difficult to get very definite information, but East Lancashire and the west part of the West Riding are the chief regions served through Manchester—apparently not very much going far south. But with regard to illuminating oils, the conditions are different. The Anglo-American Oil Company, that is, the Standard Oil Company, has mapped the whole country out into certain districts, each of which is supplied from a certain port or ports. Manchester, they say, owing to the enterprise of the Ship Canal Company, is what they recognize as a seaboard installation from which oil is distributed as far north as Lancaster, Clitheroe, and Colne, and east and south to Halifax, Huddersfield, Barnsley, Sheffield, Bakewell, Derby, Nuneaton, and the Birmingham district. Liverpool, however, which is a centre in itself, distributes over the same territory. The trade in illuminating oils seems, therefore, to resemble that in West Indian bananas, inasmuch as being in the hands of one body there is no reason why the advantages of Manchester should not be utilized to their full extent.

Much of the sugar which is imported into Manchester comes from the Continent, but it is difficult to say how far it makes its way inland, nor is there any definite region which can be claimed as belonging to Manchester. But the importance of the canal has, we believe, been considerable in reducing rates for the carriage of sugar, and the cost of conveying it has been reduced over a very wide area in consequence. Liverpool refiners, for example, send their products to Manchester free of cost in order to compete with sugar refined on the Continent which is imported there. The railway rates from Goole into Lancashire are also lower in consequence. But as our trade with the Continent is very considerable, the article in question seems to be imported at many different points in England, and we understand that what is imported through Manchester is chiefly for local use. That this is so is shown by the fact that Manchester is now the second port in the kingdom for the importation of oil (London being first). Last year the imports amounted to 176,000 tons.

There is a number of miscellaneous articles which, in the aggregate, are of considerable importance, about which we have gleaned a few details. Provisions (bacon and hams, lard, cheese, butter) are imported largely from America for consumption in the thickly populated districts of East Lancashire. Manufactured iron is introduced by way of Manchester for works in Lancashire and the Black Country. Tram-rails, setts, and road materials used in the electrification of tramway systems are imported for use in Lancashire, Yorkshire, and the Midlands.

Iron ore and pyrites are brought into Manchester in considerable quantities, and make their way as far as Leeds, Huddersfield, and Wolverhampton, and even to Birmingham, where rates with other ports are about equal.

A certain amount of wool, not considerable however, comes into Manchester for Bradford, and places like Keighley and others in the West Riding. With the establishment of regular sailings to Australia and the Argentine, there seems no reason why this should not develop to some extent.

Kaolin for the Potteries comes up the canal as far as Ellesmere port, Weston Point, and Runcorn, and is then sent on by barge to Staffordshire.

We are now in a position to draw certain conclusions of a general nature with regard to the development of the port of Manchester. In the first place, it is obvious that much depends upon the organization of the markets in which the chief imports are bought and sold. If these are loosely organized, and other conditions are not unfavourable, there seems no reason why Manchester should not import the goods in which they deal. Or, again, if these markets are so organized that the business of importing is in the hands of a single firm or combination, full advantage will be taken of the superior geographical position of Manchester. But if the organization of the market is such that it is firmly established elsewhere and cannot be moved without a certain amount of economic disturbance, there is an inertia which has to be overcome, and which will only be overcome if the geographical conditions conferred on Manchester by the Ship canal are sufficiently great.

In the second place, however, we have to notice that the articles which come most readily to a new port such as the one under consideration, are those which come in bulk. Even if the importation of a commodity is entirely in the hands of a single firm or combination, that commodity will not come up the canal if its bulk is small, and the ships which bring it to this country go, for other reasons, to Liverpool or London. On the other hand, if a whole shipload of goods of a certain kind can be sent at once to Manchester, it may go there even if the buying and selling are conducted elsewhere.

So far we have only considered imports into England through Manchester. But, of course, in considering the hinterland of a port we have to take account of exports as well. In the case of Manchester, however, these are much less important than imports. The chief export is that of coal, which goes in considerable quantities from the Lancashire coalfield. Cotton goods are sent out only in small quantities. Machinery, both from Lancashire and Yorkshire, is exported, and a certain amount of woollen manufactures finds its way from Leeds. But when we take into account the vast amount of goods manufactured within the region of the ship canal, we must confess that the exports by way of it are comparatively disappointing. There are several reasons for this. In the first place, we have to notice that ships seldom leave this country laden with one article only, and that in order for a port to have a large export trade it is essential that ships should constantly be leaving it for all parts of the world, carrying goods of all kinds. The total number of ships leaving Manchester is not yet very large, and they do not provide all the facilities which the region requires. The influence of shipping combinations has also been unfavourable, but it would not be proper to discuss this subject here.

On the other hand, the port is not without advantages of its own; the docks are connected with all the great railway systems in the country, and Manchester is the centre of an extensive system of inland canals. Further, coasting steamers coming to Manchester from other ports in the United Kingdom with goods for the surrounding district also bring goods for export abroad. For example, Plymouth steamers bring china clay for export to the cotton factories of the United States, and Dublin steamers bring ales, spirits, etc.

In conclusion, the geographical advantages of the port of Manchester are considerable, but it is handicapped at present by economic and commercial considerations, largely the result of the momentum which the older ports, and more especially Liverpool, have acquired. We cannot believe that this state of things will be permanent. Manchester will acquire a momentum of its own which will enable it to overcome the difficulties with which it is surrounded, and transform it into one of the leading ports of the kingdom.

MR. MONCKTON'S JOURNEY ACROSS NEW GUINEA.*

On November 28, 1906, Mr. C. A. W. Monckton left the Mission Station on the Mambare river, "accompanied by twenty armed native constabulary, six village constables, and about a hundred carriers. . . . The major portion of my stores I sent up the Gira river to Usi village by whale-boat. The 28th, 29th, and 30th were spent in proceeding from Umi to Usi, the tracks being badly flooded. . . . On December 1 I left Usi for the Waria. The tracks were very boggy and swampy. . . . December 2: crossed Eia river at an island. This river is about 50 yards broad on each side of the island, navigable to this point, I think, for either launches or whale-boats, but flowing into German territory, and having its source in a low range near Mount Albert Edward. . . . Large numbers of rubber trees exist between the Gira and Waria, and for rubber-growing purposes the land should be highly suitable. . . . Very heavy rain fell most of the day; there is a small village, a colony from Usi, at the crossing of the Eia. Crossed Wuwu river; this river heads in swamps towards Mount Albert Edward, flowing into German territory. . . . Camped at Eatuna village on the Waria. Damadu village, at which point I appointed a village constable, is a short distance below. . . . The Damadu people . . . brought me a large quantity of taro and food, and no less than fifteen pigs, among them a number of red pigs which they said they had captured some years ago at the Wuwu river.

* This communication is sent by Dr. C. G. Seligmann, who writes as follows (for map, see p. 328 of this volume):—

"In the September number of the *Journal*, speaking of Mr. Monckton's journey across New Guinea from the Mambare river to the Papuan gulf, you say 'the results of the expedition are embodied in our map, but no account of it is available, Mr. Monckton having left this country, while no reference to it appears in the Annual Report for 1906–1907, unless, possibly, in the statement that it lately had been ascertained that the tribes on the upper Waria were resident in British territory.'

"Last autumn Mr. Monckton allowed me to make a copy of his official report of the journey, and I have recently heard from him that he wrote to you from Madeira last November, giving some account of his experiences. As it is clear that you have not received this letter, and as Mr. Monckton has recently written to me concerning this letter and the Society, I now send you some extracts from Mr. Monckton's official journal. For it seems better to let you have this information while your article is still fresh than to wait the length of time necessary to communicate with Mr. Monckton and receive his answer."

"In a creek near the Waria is a curious outcrop of white rock, which Mr. Parkes —who has been an opal miner in Australia—told me was called by miners opaline, and occurs where opal is found in that country. . . . On the 4th I arrived at and camped near Emigi village on the Waria. December 5: . . . Travelled over a very high hill, and then along rough tracks all day. . . . I passed an island in a river on which, at one time, a village had been situated; but the village had been abandoned, and the suspension bridge which led to it cut. The waters of the river, which were very turbulent and rapid, were a deep, dark slate-colour."

"Apparently the climate of the Waria during the South-East season is very dry, for I noticed several clear 'burns' in the gardens, and the natives merely fell the bush and allow it to lie for a couple of months, and then fire the whole lot as it lies on the ground without any preliminary 'logging-up' or chopping process—a practice that I have not met with previously in New Guinea, where the clearing up of the ground after the trees have been cut down is the major part of the work. The country on both sides of the Waria river is here very rough and broken. . . . I noticed maize of not very good quality growing in the gardens, and excellent tobacco."

"December 6: Travelled over very rough country all day, and camped near Giguiari village, after crossing nine bad creeks. . . . December 8 was spent in travelling over rough high hills, from which I obtained a view of Mount Albert Edward (south), and a big bare-topped mountain south-west, which . . . the natives called Gudimani. I came to the conclusion that I was about 10 miles in British territory. I could see from here that a branch of the Waria river heads under the column of Mount Albert Edward, and another from the north-west."

"December 9: Crossed the Waria by means of a high and particularly nasty suspension bridge. The bridge consisted of two cables of twisted vines, fastened together at a distance of about 3 feet by other vines. One walked on the bottom one and clung on to the top one; the bridge was about 50 feet high at one end, and 15 or 16 at the other, with a raging torrent underneath. . . . Camped in a village called Sisireta, where there was a large dance-house of neat construction; the village had been deserted for some time. December 10: The trails I followed led south-south-east and south-west, until, from a high spur, I obtained a bearing on the column of [Mount Albert Edward] of 168°. . . . Arrived at Beri during the afternoon to find that the villagers had deserted it, though a new club-house was in course of completion. . . . In the club-house there were a large number of long bamboo tubes, which the natives used instead of drums when dancing, producing a booming note by striking the end on the ground."

"The surrounding country was of poor soil, with grassy hills and stunted scrub, mainly a granite formation. . . . The Sisereta and Beri people are of poor physique; a large creek called the Wowo runs into the Waria some distance below the Sisireta crossing. December 11: . . . Travelled north of west over very bad hills all day, and camped at a small creek near a grass patch. . . . December 12: Crossed a branch of the Waria coming from the main range. . . . December 13: . . . Followed tracks running west-north-west on the side of the range through a maze of villages. . . . The natives in this part apparently do not smoke."

Mr. Monckton mentions bows, arrows of several types, and wooden clubs as the weapons of these natives.

These people "do not use spear pits or ground spears; they, however, set large timber 'figure of 4' traps for pig and wallaby, . . . also a heavy weight 'fall trap' for the same animals, sprung by a trigger and line. . . ."

After spending December 14 in crossing six low ranges of hills in heavy rain, Mr. Monckton arrived at Segasira village on December 15, near which a large creek

called the Korovi runs into the Waria. On the 16th a short march led to a big creek, the Ono, running from the north-west; on the 17th camp was shifted across the Ono creek to the bank of the Waria. . . . On December 19, being then camped at a height of 2636 feet, Mr. Monckton picked out his weakest carriers and sick and sent them back to a Tamata under escort. On December 20, moving across a fine grass tableland, Mr. Monckton passed several deserted villages and gardens. "All these villages are stockaded, and their vicinity was guarded by old spear pits. . . . Tobacco and sweet potatoes had been planted on some old graves, and a netted bag was suspended overhead." On December 21 Mr. Monckton marched all day over grass flats and low scrub-covered hills, reaching, on December 22, a large grassy spur, "on which was a . . . stone land or tribal boundary mark, and on which I cut a broad arrow. This was the extreme point visited by previous parties. . . . The Waria here divided, one branch heading from north-west, . . . and the other from south-west, through the main range.

"I estimated my position to be about on the edge of British territory and north-north-west from Mount Albert Edward. The main range runs in almost a straight line north-north-west from Mount Albert Edward." By this time only eight bags of rice remained, and it was accordingly necessary for the carriers to make sago. The right branch of the Waria was here of a "very dark lead colour," and this branch "lends its distinctive colour to the Waria all the way to the coast." On December 26, Sergeant Barigi, who had been sent out to the south-west to search for tracks, returned reporting a densely populated valley lying south of west, but he could not get into intercourse with the people. On December 27, Mr. Monckton travelled across the hills, "first by way of a small creek to south-west, and then up a spur to west," along the summit of which he journeyed south until he met with a native track running in this direction at about a height of 7000 feet, which was followed nntil it led to a grassy densely populated valley on the upper Waria. The old village in which camp was made "was built in a parallelogram within a square enclosure formed by a strong fence and a hedge, at one end of which was a fairly large well-built house, evidently once used for ceremonial or religious purposes. Each of the villages in sight was laid out in the same form, and each had the same isolated, fence-secluded building attached. The height of the village . . . was 5386 feet above sea-level. For the first time in New Guinea I found openings for windows in the houses, closed at night or during rain by curtains of native cloth. . . . In the ceremonial or clubhouse large stocks of new arrows were found; one arrow in each bundle was smeared with fresh blood."

On December 28 Mr. Monckton continued his march in a south-westerly direction, crossing a ravine on the far side of which several villages were situated. "A large stockade of green timber nearly 30 feet high had been built in the night across the track, in front of which a large space had been cleared. It appeared to me . . . that the stockade had been erected to prevent my party approaching the large ceremonial house. . . ." On reaching the top of a hill which it was necessary to ascend, Mr. Monckton came in sight of a large village. The natives "who came in were of the Semitic western type, wearing the broad bark abdominal bandage of the Gulf people. They had steel tools obtained from one of the German rivers to the north, with which they maintained trading relations. . . . They knew a few words of English taught to them by German natives at a place called Sipoma."

On the 29th Mr. Monckton travelled all day up a valley in a south-westerly direction, and "camped near a village, where more pigs and food were brought for sale. The natives pointed out nine sweet potato gardens full of pigs. . . . These people apparently make potato gardens solely for the purpose of feeding pigs in, as yams appear to be their staple diet." The natives at this point were a fine type of

people, but somewhat overbearing and truculent. They gave Mr. Monckton to understand that their steel tools came across the mountains from the south-west, and that flat country lay three days' journey in that direction, but that the people ahead were numerous and hostile to strangers.

On December 30 Mr. Monckton moved in a south-easterly and southerly direction, and, after some days passed in looking for a track, spent January 3 travelling 6 miles in a south-westerly direction, wading up the bed of an icy-cold creek, in which were many old stone fish weirs.

On January 4 the march was resumed in a southerly, south-easterly, and finally south-westerly direction, descending into a valley with streams flowing to the south-west, and so into a village surrounded by large gardens, situated on the extreme north-easterly affluent of the Lakekamu river, at a height of 2422 feet. "The houses here were of a totally different type to those on the Waria, being squat and oval-shaped instead of square and high. The village was surrounded by low fences, enclosed within which were scores of pigs, which camped at night under the living-houses." The villages here are not fortified or stockaded in any way, but the houses, like those of Waria, were rendered arrow-proof by thick bamboo walls. The women wear petticoats similar to those worn in the neighbourhood of Port Moresby.

On January 5 Mr. Monckton succeeded in making friends with these people, who use tobacco "in the form of cigars, which are smoked through a . . . holder made of a joint of bamboo about half an inch in diameter and 4 to 5 inches long. Maize, cucumbers of good quality, and a large bean are much grown and used by them." Near this village there was a suspension bridge over a stream built on the cantilever principle.

On January 6 Mr. Monckton recrossed the river and camped at a height of about 1500 feet.

January 7 was spent in crossing rough spurs. There was no defined track, and villages were now absent. Mr. Monckton notes, "The Lakekamu was now about the size of the Kumusi at the Yodda road crossing."

On January 8 the journey was continued along the bank of the river, the water of which was of a remarkably deep green colour. The river at this point was very rough and rapid. On January 9 the river began to show signs of being navigable for rafts.

On January 10 "the party travelled for three hours over flat swampy country, . . . and then camped to make sago and built rafts. The stream now ran about 2 knots, and was entirely free from snags."

On January 11 a start was made on the rafts at 8 a.m. For about an hour the river was descended in safety. The banks of the river became more swampy, "and the rate of the current increased until it was well over 4 miles an hour, but still clear of snags until we came to where the river forked, as I thought, the left-hand branch being followed by my raft. In obedience to a shout of warning from my raft, caused by snags being sighted, and the current becoming dangerously rapid, . . . about half the rear rafts took the right-hand branch to pass, as I thought, around the island. Suddenly a wall of timber appeared in front of us, the river meanwhile becoming almost a cataract and crowded with snags, and into the wall we dashed, my raft, which was only saved from capsizing by the magnificent pluck and nerve displayed by the police, being guided and pushed into the only quiet spot of water.

"Our shouts of warning were mainly drowned by the roar of the waters, but in any case no human power could prevent the rafts closely following me dashing into the wall, and one by one they did, precipitating, with one exception, their loads of men and gear into the torrent, some smashing and capsizing on snags before reaching the wall of logs and trees. Man after man crawled or was dragged from the

water and from the snags they were clinging to upon the log wall until apparently all were safe.

"After we had recovered a little from the effect of the capsize, Lance Corporal Oia tried to make his way through the reeds and swamp to the other branch taken by Sergeant Barigi, only to return bringing a number of crocodiles' eggs, and to report that the swamp was impenetrable, infested with crocodiles, and the current in the stream too strong for us to make way against. . . .

"The whole river at this point spread out and flowed through a tremendous sago swamp, and how far that swamp was through we had no means of telling. The whole of the logs and swampy points we were then on showed signs of being submerged for a depth of 4 or 5 feet by the nightly floods due to rain, rendering our present unhappy position yet more insecure and dangerous.

"The first matter, however, was to recover our ammunition, then at the bottom of the river, a work of great difficulty and danger for the police, who had to dive and make fast cords to the handle of the box. While several of the police were engaged at this work, others and carriers were engaged cutting through the barrier of logs and recovering the material composing our rafts, as it was plain to me that the only hope of saving the men with me was to cut a way with the current, clean through the swamp on to the other side, as to retrace our steps or extricate ourselves in any other way was quite impossible. . . . After about an hour's heavy chopping, carriers and police relieving one another, and spurred to great exertion by the knowledge that if the river rose and caught us in our then position we must inevitably perish, the barrier was cut through and my raft started, cutting and forcing a way through the flooded forest, . . . the remaining rafts as they were repaired following in our track and sending men to help us in cutting or hauling and pushing the leading raft through or hauling it away from clumps of sago or trees against which the current would perpetually swirl in. Once a dead tree, whose fall was fortunately broken by a sago palm, fell right across the raft, and had to be cut into sections in order to release the craft.

"After a day of awful toil for the men, we emerged into a reed-surrounded lagoon with miles of swamps on every side, but where the rafts would float without danger of swirling currents. Here also the place was infested with crocodiles, and literally humming with mosquitoes. Here we tied the rafts up to reeds, while shots were fired and efforts made to collect as many of my party as possible before night, now fast closing in.

"Lance Corporal Oia flopped through the reeds and water to where a clump of bigger timber seemed to promise dry land, and at last yelled that he had found a place big enough to pitch camp on, with dry firewood, and there, after an awful struggle through the reeds and water, I went. Shortly after a raft appeared with Sergeant Barigi and two A.N.C. He stated that he had found the second branch of the river closed, and had then followed me, but meeting with a flying crowd of carriers headed by Private Daimaba, and being warned of the disaster I had met with, had abandoned his raft above the danger point and swum and crawled through the reeds until he had come to the channel cut by my raft up to some timber, where he had constructed a raft and followed."

The police and carriers were set to work making sago and building canoes and rafts, with the result that on January 15 the journey downstream was resumed. A big river "navigable for large launches, and perfectly safe for either canoes or rafts," was reached on the same day. The dangers of the journey were now over, and two days later Mr. Monckton reached McGowan's plantation on the Lakekamu, thus completing the crossing of New Guinea by a new and most adventurous route.

GEOGRAPHY AT THE BRITISH ASSOCIATION.

THE British Association met this year at Dublin, on September 2–9, and the work of the sections began on Thursday, September 3. To the meetings of Section E (Geography) the theatre of the Royal Dublin Society, in the fine buildings in Kildare Street, had been allocated—an admirable chamber acoustically, and excellently equipped for the purpose of exhibiting lantern-slides. The President of the section was Major E. H. Hills, C.M.G., R.E.; and the other officers and sectional committee, as finally constituted, were as follows:—*Vice-Presidents:* Rev. W. Spotswood Green, C.B., M.A.; Captain H. G. Lyons, R.E., D.SC., F.R.S.; Major Leonard Darwin, R.E.; Major C. F. Close, R.E., C.M G.; J. Bolton; Dr. A. J. Herbertson; Prof. W. M. Davis. *Secretaries:* O. J. R. Howarth, M.A. (Recorder); W. J. Barton, B.A.; E. A. Reeves; W. F. Bailey, C.B. *Committee:* Staff-Commander E. Dubois-Phillips; Captain H. L. Crosthwait, R.E.; J. Howard Reed; Dr. H. O. Forbes; Major W. L. Forbes; H. O. Beckitt; Dr. H. R. Mill; Prof. J. L. Myres; Prof. R. A. Gregory; J. Macfarlane; H. G. Fordham; W. L. Grant; Dr. W. S. Bruce. Mr. G. G. Chisholm, on leaving the meeting early, vacated the position of vice-President, and Mr. J. G. Bartholomew was prevented from attending and filling the same office.

The President took the survey of the British Empire as the subject of his address to the section (reported in full elsewhere in the *Journal*). Major Leonard Darwin, in proposing a vote of thanks for the address, touched upon the possibility that if a further war occurred in South Africa, the lack of maps would be felt in some measure as it had been felt before. He said that two schools of thought existed with regard to the mapping of British dominions; according to one, maps, even if indifferent, should be made at once where they did not exist; according to the other, maps were useless unless based on a thorough and careful survey. He thought this controversy would be settled if the government undertook the work on proper lines. Sir David Gill, seconding the vote, strongly urged the same point of view, and also supported the President in his recommendation that the two principal arcs in Great Britain should be remeasured. It may be added here that this latter recommendation was subsequently embodied as a resolution of the sectional committee, inviting the Council of the Association to suggest to the Board of Agriculture and Fisheries that the Director of the Ordnance Survey should undertake the work as part of the current work of his department. In connection with the lack of maps of certain British dominions, Major Darwin stated at the meeting on Friday, September 4, that he did not wish his remarks on the previous day to be taken as reflecting on the excellent work carried out by the Colonial Office in the direction of surveying, and Major Hills supported this attitude from the chair.

Prof. W. M. Davis followed the presidential address on Thursday with a paper on "The Physiographic Subdivisions of the Appalachian Mountain System, and their Effects upon Settlement and History." He pointed out that the system may be divided into the crystalline longitudinal belt on the south-east, and the stratified longitudinal belt on the north-west, with the Appalachian plateau to the north-west again. The crystalline belt is low, narrow, and interrupted in a middle section; it is higher and broader in the north-east and in the south-west. The stratified belt is most characteristically developed in a middle section, where alternations of resistant and weak strata result in alternations of ridges and valleys; in the north-east the ridge-making strata are absent; in the south-west they are of less strength than in the middle section. The plateau belt continues in full

strength along the greater part of the stratified belt in the United States, but it terminates in Eastern New York. Farther north it may be said to be replaced by the Adirondack mountains, separated from the plateau by the Mohawk valley. The lecturer pointed out the manner in which these various physical structures had offered routes or opposed barriers to the progress of settlement.

In the afternoon the Rev. W. Spotswood Green attracted a large audience to his lecture entitled, "Ireland: her Coasts and Rivers." Taking the theme that geographical and social conditions are so closely bound together that they may almost be regarded as aspects of a single problem, the lecturer first illustrated various typical aspects of Irish scenery (mainly coastal) by means of admirable lantern-slides, and then appended appropriate remarks on the physical history and early social history of the country. The especial interest which he had in view was that of those visitors to the association meeting who intended to extend their knowledge of Ireland beyond the immediate neighbourhood of the capital, and from this point of view the lecture was evidently appreciated in full.

The greater part of Friday morning (September 4) was devoted to education. Prof. R. A. Gregory, in his paper on "School Geography as a Mental Discipline," said that though there are many sciences there is only one scientific method, consisting in the collection and arrangement of facts with the view of discovering relationships and arriving at correct conclusions. The teaching of geography is slowly coming into line with this method, and it is being recognized that the scientific aspect of geography should be a matter of personal observation rather than of description. Suitable exercises should be devised, on maps beginning with the district known to the pupil, and passing thence to other larger areas. Geography should not be taught as information to be remembered merely; numbers and symbols should not be set before pupils without explanation of their meaning and bearing. Pupils should rather be brought face to face with evidence and trained to study it for themselves. Along with opportunities for personal inquiry, descriptive lessons or reading should be set so as to encourage interest in the earth and its inhabitants. In the discussion which followed, Dr. A. J. Herbertson said that if it was found impossible to arrange practical work, the school curriculum must be at fault. Deductive, as well as inductive, methods must be taught. For the purpose of local field work and teaching by personal observation, ordnance survey maps, he pointed out, could be obtained by teachers at nominal prices. Mr. H. G. Fordham advocated instruction in the growth of geographical knowledge by means of the comparison of early engraved maps with modern maps. Major W. L. Forbes, in answer to comments on the difficulty of obtaining proper geographical qualifications in teachers, said that chairs of geography must be established in all universities, and teachers must be properly trained, before really good work can be done in the schools.

Prof. J. L. Myres then gave a paper on "The Geographical Study of Mediterranean Man, considered as an element in a 'Classical Education.'" He had found that the knowledge obtained by university students of the history and social conditions of the Greek and Roman world is obtained without regard for accompanying geographical conditions. Correlation of the study of geography with classical (and other) studies is ignored. Yet geographical study, at an early stage in the classical course, would familiarize students with the background on which to draw in the historical and social picture. But teachers of classics were not generally, at present, equipped to give appropriate geographical training. After this paper the Rev. T. Corcoran, S.J., made the interesting point that German classical cartographers had apparently studied Roman history to the exclusion of Greek, and that their maps showed a regrettable partiality towards the illustration of the former.

Following these papers Dr. W. S. Bruce showed some fine lantern-slides, which were greatly appreciated, of views taken on the *Scotia* Antarctic expedition, and in his accompanying remarks referred to the scientific results of that expedition, now in course of publication. A magnetic observatory was established at Scotia bay in the South Orkney islands, and named Copeland observatory after the late Prof. Ralph Copeland. Here Mr. R. C. Mossman carried out observations during the wintering of the *Scotia*, and during her absence at Buenos Aires. Captain Thomas Robertson made tidal observations every half-hour at Scotia bay, and these showed a remarkable normality. Mr. Mossman's meteorological observations have especial value since the Argentine Government undertook to carry on the observations at Scotia bay, and have now five years' continuous records there. The line between easterly and westerly systems of weather is found to be about 65° S. in the Weddell and Biscoe seas. The observations in ocean physics are now in process of working out. By bathymetrical observations the expedition has showed the Ross deep to be non-existent; a depth of 2660 fathoms was found, for example, where Ross reported 4000 fathoms. "Rises," with less than 2000 fathoms depth, connect Graham's land, the South Orkneys, and the Sandwich group, as well as the south of South America and Antarctica, and south of Gough island a continuance of the mid-Atlantic rise 1000 miles to the south was sounded. Topographical work included a detailed survey of Laurie island in the South Orkneys, and a running coast survey of the north side of Coronation island, and of 150 miles of the new coast-line discovered by the expedition and named Coats Land. Biological collections were made both from the surface of the sea and from great depths. The results of these observations tend to destroy the value of the theory of bipolarity. The meteorological, deep sea deposit, bathymetrical, and biological observations all go to indicate the existence of continental land not far to the south and west of the South Orkneys.

In the afternoon, Mr. W. L. Grant, assistant to the Reader in Colonial History at Oxford, gave an illustrated lecture on "The Northward Expansion of Canada," introductory to the visit of the Association to Winnipeg in 1909. He showed that at the federation Canada "was length without breadth." He compared it now (that is to say, its present developed area) to the form of a wasp with its waist at Winnipeg. The progress of the country had depended on the spread of knowledge as to geographical conditions (for the ignorance as to these was even until lately profound), to the growth of confidence, and to the conquest of such conditions as were unfavourable. He brought out the noteworthy point that railway construction proceeded in advance, not in the rear, of settlement.

The Saturday (September 5) was as usual devoted to excursions.

On Monday morning (September 7) Mr. E. A. Reeves exhibited and described three instruments recently designed by him for the use of travellers and surveyors—(1) The distance-finder alidade for plane-tabling; (2) The astronomical compass and time indicator; (3) a new form of reflecting artificial horizon. Mr. H. G. Fordham followed with a paper entitled "Notes on the Cartography of the Counties of England and Wales." He summarized the results of his inquiries into the history, bibliography and characteristics of the engraved maps of the counties. He indicated the position of the Dutch, Flemish, and French schools of geographers in relation to the contemporaneous work in England at different periods, and established a classification by reference to the initial meridian lines adopted, and to the style and art developed by engravers in this department. He also noticed the principal authors and their best-known works in chronological order, and mentioned, by way of illustration, that in all about 400 maps have been published of the county of Hertford, of which, however, more than one-half are reprints, more or less

altered from the original plates, and may be regarded as duplicates. A complete collection for any other country would contain approximately the same number. The large number of original maps which he exhibited to illustrate his remarks were examined with great interest.

In the afternoon Captain H. G. Lyons (who, it may be mentioned, received an honorary degree of Trinity College, Dublin, during the meeting) read a paper entitled "The Longitudinal Section of the River Nile." He said that in the course of the survey of the upper Nile region work had been done which, *inter alia*, almost completed a line of levelling from the Mediterranean to Victoria Nyanza, a distance of 3500 miles. The equatorial plateau consists of great crustal blocks, the level surfaces of which are occupied by such lakes as Victoria, Choga, Albert Edward, and Albert. From the foot of the plateau stretches the level plain of the Sudan, where the rivers (Bahr el Jebel, Zaraf, and others) have a very slight slope —little more than 3 inches per mile. The flattest part of the course of the Nile is between the Sobat and Khartum, where the slope varies from half an inch to one-third of an inch per mile. Below Khartum the character of the river-bed changes; reaches of rapids where the river is eroding the crystalline rocks alternate with reaches of lower slope where the rock is sandstone. These crystalline rocks therefore form natural obstructions which can easily be converted into dams for storing up water in the valley above. In these rapids the slope is at times steep, but never for any considerable distance, and the mean inclination rarely exceeds 1 in 1000 for any length of river. At no point can the river be said to descend a vertical fall; the cataracts are, in fact, reaches in which the river has cut its way down to portions of the ancient and uneven land surface formed of the crystalline rocks on which the sandstones of Cretaceous age have been laid down. The position of the ridges of this ancient land has determined the places where cataracts occur, but the water-channels in them follow the lines of weakness due to bands of softer rock or to lines of fracture caused by the movement of the crust during long ages. The last of these barriers is at Aswan, and below this the river flows in the wide alluvial plains which it has formed by deposition, and is building up at the rate of about 4 inches per century. The equatorial plateau and the region of the cataracts are regions in which the river is eroding at the present time, while in the Sudan plains and in Egypt deposition is taking place.

The meeting on Tuesday morning (September 9) opened with a short paper by Mr. L. C. Bernacchi on his journey into the region of the Rio Inambari in Peru, where in 1907 a preliminary survey was carried out in practically unexplored country at the expense of an English rubber company. On the steep eastern slope of the Andes Mr. Bernacchi noted a remarkable variety in succession of temperature, scenery, and vegetation. The forests are rich in fine Para rubber trees, and the working of these and other forest products is gradually opening up the district. The inhabitants are mainly Quichua, but of greater interest are the Atsahuaca, a people of excellent disposition, who are monogamists, and live by hunting. They are nomads, and are nearly extinct in the Inambari district.

The Rev. George Furlong lectured to a very large audience on his remarkable experiences at the birth of the volcano of O Le Mauga Mu in Savaii, Samoa, where he was a missionary. After a period of earth unrest, two fissures opened on August 4, flame-coloured steam and vapour broke forth with heavy explosions, and masses of débris were ejected, and soon began to build up the crater. Streams of lava carrying other matter rolled from the vent; their rate of progress was calculated at half a mile in twenty-four hours. The behaviour of these lava-streams was carefully watched by Mr. Furlong. He observed that the surface of the lava quickly solidified, and thus a tunnel was formed through which the flow went on, so that

between the crater and the vast columns of steam where the lava reached the sea it was difficult to realize that volcanic action was in process. He believed that the volcano was more active during the period of full moon than of waning moon; also, that the fumes from the volcano were not always of the same nature. Several tidal waves were experienced, always in the same place; they were about 500 yards wide, and flowed inland about 100 to 120 yards. These waves were observed to occur when the crater was more than usually active. Mr. Furlong's remarkable lantern slides showing the volcano in action were received with high appreciation.

Dr. W. S. Bruce then gave a lecture, illustrated with lantern slides, on his work in Prince Charles Foreland, off Spitsbergen. A committee of the Section, of which he was secretary, reported to the present meeting on this work, and Dr. Bruce now amplified the report by describing his methods of work and his experiences.*

The afternoon was devoted to a subject of local interest—the exploration of certain of the extensive caverns which occur in the Irish limestone, by Mr. Harold Brodrick and Dr. C. A. Hill. Mr. Brodrick describes his experiences, and gave the results of his careful surveys and observations in the Marble Arch caves in county Fermanagh, a full account of which, with complete measurements, was promised for publication in the *Irish Naturalist*. Dr. Hill gave a similar description of the well-known Mitchelstown cave in county Tipperary, in the Blackwater valley. He showed that there are actually two separate and distinct caves. The existence of one, the "old" cave, is now forgotten, though this cave was known and exhibited in 1777. The "new" cave, first discovered in 1833, is now the only one shown to visitors. Very little is known of the full extent of the caves even at the present day, and no reliable plan or map exists. Dr. Hill, visiting the cave in 1905, took many photographs, of which he now showed lantern slides, and also explored portions till then unvisited. The cave was found to be of much greater extent and complexity than was previously imagined. Geologically the "new" cave is of great antiquity, as evinced by the enormous size and number of the stalactite and stalagmite formations. There is no evidence of present active water-action, the cave being practically dry, except at two points, erroneously called "the River." The explored passages are estimated at 1¼ mile in length.

These papers brought a successful meeting to a close. Of the reports of the committees of the section, reference has already been made to that associated with Dr. Bruce's work in Spitsbergen. That of the Committee for Investigations in the Indian Ocean, of which Sir John Murray is chairman and Mr. J. Stanley Gardiner secretary, showed that work is in active progress. The same applies to the Committee on Rainfall and Run-off, which, however, did not present a report. Mr. R. T. Günther reported that, although he hoped to revisit Italy before publishing the results of the Investigation of the Oscillation of the Level of the Land in the Mediterranean Basin, the object for which this committee was appointed is accomplished.

Among papers read before other sections, allusion on the score of geographical interest should be made to that on the Veddas of Ceylon, by Dr. C. G. Seligmann, read before Section H (Anthropology). He showed that at the present day the Veddas fall into groups characterized by different sociological features. The coast Veddas have borrowed largely from their Tamil neighbours, while the village Veddas have, to a considerable extent, intermarried with the Sinhalese. Nevertheless, both groups retain the remains of their old clan organization in the majority of their settlements, showing their connection with those less contaminated and wilder folk who have commonly been spoken of as "rock" or "jungle" Veddas.

* See paper by Dr. Bruce in the *Geographical Journal* for August, 1908.

On the psychical side, the life of all Veddas is unusually limited in every aspect except one, namely, their regard for the dead, and even this regard, which attains the intensity of a cult, has given rise to no decorative art. But it has given rise to a series of dances, usually accompanied by offerings of food to the spirits of the departed. Though others take part in them, these dances are performed especially by men who have been trained to invoke the *yaku*, as the spirits of the dead are called, and the use of a ceremonial arrow with a blade over a foot long and a short handle is an indispensable feature of some of these ceremonies, in all of which the "shaman" becomes possessed by one or more of the *yaku* he invokes. All Veddas speak Sinhalese, or dialect of Sinhalese, but in addition many Veddas have also a small number of words which are not obviously Sinhalese, or are Sinhalese periphrases. These classes of words are specially used in hunting and in addressing the *yaku*.

The presidential address, by Prof. Ridgeway, to the Anthropological Section, contained an interesting discussion on the subject of environment and race, which was published in the October number of the *Journal*.

THE SOUTHERN KALAHARI.

There has recently been presented to the Cape Parliament an interesting report on the Rietfontein area of Bechuanaland, which, though principally composed of the Vilander territory, also includes a slice of the Southern Kalahari. The report has been drawn up by Mr. J. F. Herbst, the assistant resident magistrate, and is based on four years' experience of the country, only a very small part of which has been surveyed.

Describing the physical characteristics, Mr. Herbst distinguishes two main features; the one, a region of hard stony veldt, consisting of plains and flat-topped ridges at wide intervals; the other, an immense undulating expanse of sand, covered with grass. The red sand-dunes can be seen impinging in long irregular lines like tongues of flame on the hard veldt region, but they do not seem to have extended their encroachments within the memory of any one living. The dunes run for the most part in parallel lines east and west, and the intervening valleys (called "straate," the Dutch for "streets") range from 100 yards to 2 or 3 miles in width. Dotted about in the sand are found extensive basins, known as "pans," usually from about 100 yards to a mile in diameter, with beds as level as a billiard table. In some, white lime predominates, while others have a surface of reddish-brown loam. After rains they are covered with a few inches of water, which generally becomes brackish after a few days. At Haakscheen there is a specially large pan, formed by the storm waters of the hard veldt region being dammed by the sand dunes. When full it comprises a sheet of water 16 miles in length by 6 in width, and attracts large numbers of water-fowl, but it retains water only for about three or four months in the year. There are also two large salt-pans within the area, one of which is capable of an output of thousands of bags yearly. Towards the basin of the Molopo river flats of sand occur, with peculiar flat rocks of limestone a few inches underneath. Here there are large depressions with abrupt walls, resembling artificial excavations, which Mr. Herbst thinks were clearly at one time lake-beds, though now perfectly dry.

The general slope of the land is in a southerly direction, with a depression down the middle, where lies the bed of the Molopo river after being joined by the Nosop —with its tributary the Ouap—out of German territory, and by the Kuruman

river from the east. All these are perennial streams in their countries of origin, but Mr. Herbst states that in the Rietfontein area only the Kuruman has been seen to flow within the memory of living man, and that was in 1894. Judging by their size, he thinks there is no doubt that the river-beds formerly carried considerable streams of water. They are still bordered on either side by thick belts of acacia and other trees, sometimes as much as 2 miles broad. Mr. Herbst also infers that the river-beds have been raised considerably, since in the wells that have been sunk in their courses, white shingle, beautifully smooth and rounded by running water in times past, is found 50 feet below the present surface. Below this shingle the water is found.

The climate is described as equable on the whole, but subject to occasional rapid changes. Mr. Herbst has seen the thermometer drop in summer from 110° in the shade to 60° in the course of six hours, while a temperature of 50° at 2 p.m. in mid-winter has risen to 90° in twenty-four hours. During the summer of 1906–7, in the five months November to March, there were sixty-six days on which the temperature rose to over 100°, the monthly average of the daily shade readings at 2 p.m. ranging between 94° and 98°. In the five winter months, May to September of last year, the monthly average of the daily readings ranged between 64°·8 and 73°. That, however, was an unusually warm winter, with frost on only two occasions. Usually there is a good deal of severe weather in July and August. Except during June and July, scarcely a day passes without wind from one direction or the other, often in force from every point of the compass within a few hours. The rainy season extends from December to March, and is fairly regular year by year; but in the summer of 1896–7 there was no rain, and up to the date of Mr. Herbst's report in the middle of February this year there had been no rain in the summer of 1907–8. The average rainfall Mr. Herbst places at from 7 to 9 inches.

In these circumstances, what Mr. Herbst describes as the wonder of the Kalahari is its profuse vegetation. After the summer rains the various grasses grow to a height of 2 or 3 feet, giving the country the appearance of a vast cornfield, and so thick is the undergrowth that one can hardly realize it hides the dreaded desert sand. Specially important in the economy of the desert is the "tsamma," a plant belonging to the gourd family, and resembling the ordinary water-melon plant, save that its leaves are slenderer and smaller. There are two species, one tasteless and the other markedly bitter, between which the Bushman can readily distinguish at sight, though the inexperienced have to judge by taste. The plant has a very destructive effect on steel, blunting the sharpest knife after a few minutes' use, and the Bushmen cut it with home-made bone knives. It bears in great profusion. Mr. Herbst has counted over a hundred melons on one stalk, and during a good season it is unsafe to gallop a horse through the "straate," so thickly do the melons lie on the ground. The first frost kills all the leaves and stalks. The fruit remains wholesome for about twelve months after maturity; then it dries, and the seeds are ready to grow with the first rains of the following summer, so that it reproduces itself only every other summer. A good "tsamma" season is always followed by a poor one, and *vice versâ*. In its raw state the fruit is chiefly remarkable for its thirst-quenching properties, but as food it fattens cattle with remarkable rapidity, and when cooked also serves as a food for man. Other members of the gourd family indigenous to the Kalahari are the spinous wild cucumber and the gemsbok cucumber, while, as a result of the summer rains, enormous quantities are found during the winter of what the Bushman calls "Nabba" and the Dutch farmer the Kalahari potato, but which Mr. Herbst says is nothing more nor less than the European truffle. The varied grasses of the Kalahari also serve a valuable purpose

as a food for grazing animals, the most notable varieties being the two kinds of Bushman grass, the "Langbeen," a tall, sweet grass, and the "Fijn Twoa," a more delicate and richer grass. On some of the farms on the outskirts of the Kalahari the Australian Salt bush has been cultivated with some success on the edges of the pans, but in the Kalahari itself the soil is so fresh that the bush loses its saline properties.

Formerly, the Rietfontein area was the habitat of almost every species of the larger fauna, but the numbers have been greatly reduced by the joint attacks of Bastards and Bushmen. In the last few years protective laws have somewhat checked the slaughter, and Mr. Herbst notes that the animals are returning to some extent to their old haunts, gemsbok and ostriches in particular having increased considerably. The Bushmen, instigated by the whites and Bastards, still levy heavy toll upon the game in the recesses of the desert, and considerable quantities of hides and feathers exchange hands; but the greatest destruction is wrought by the wild dogs, which hunt in large packs, and not only kill but wound in a wholesale manner, for they will not touch dead meat, but eat it from the living animal, whom they gash in a shocking manner as they race alongside.

Mr. Herbst gives an interesting account of the occupation of the Rietfontein area by the Vilander group of Bastards, who first moved in about the year 1865, and who, in turn, have been largely ousted by whites. Bushmen now exist in the country only in isolated groups. When the Bastards arrived they found, Mr. Herbst states, two tribes of Bushmen, the one a diminutive yellow race called "Gommanes"—probably fugitives from Cape Colony—the other a darker and taller race living on the Nosop river, among the Bechuanas, from whom they doubtless inherited their swarthy complexion. The yellow race is almost extinct, but a mixture is still found in the Kalahari.

Practically the only industry is stock-raising, which has been successfully carried on since the country was first occupied by the Bastards. Cattle, horses, Afrikander sheep, and the common Boer goat were then introduced, and the sheep and goats in particular multiply with remarkable rapidity. Except in the low-lying valley of the Molopo river, stock disease is practically non-existent. The permanently habitable portions of the country, however, have now been fully taken up, and hold as much stock as they can carry. For the future settler there is only the waterless Kalahari. If the summer rains could be relied on regularly, a permanent water supply could be dispensed with, as the "tsamma" would be sufficient for all needs. Even under present conditions numbers of Bushmen and stock exist in the desert for many seasons without water, except just after rain. With a permanent water supply stock-farming could be conducted on a large scale; but no proper attempts have yet been made to find water in the Kalahari. Mr. Herbst suggests that, as in other limestone regions, there may be underground rivers. He thinks it almost safe to say that no good water will be found at the depths at which ordinary wells are sunk, and, to his mind, the solution of the problem, if solution there be, lies in artesian wells. Experiments of that nature can only be undertaken by the Government, but Mr. Herbst is so persuaded of the great potential resources of the country that he urges every effort should be made to discover whether water cannot be found.

REVIEWS.

ASIA.

Asiatic Travels.

'Selections from Travels and Journals in the Bombay Secretariat.' Edited by G. W. Forrest, C.I.E. Bombay: 1906.

This volume contains a variety of journals, letters, and records of travel brought together and published by Mr. Forrest, ex-director of records at Bombay. From a geographical point of view they are no doubt interesting, but the editing is hardly so satisfactory as it might have been. As to whether these papers had been published before, the editor gives little definite information in his "Introduction." One of the more voluminous papers is a series of letters by C. Masson, the American orientalist, who travelled in Afghanistan some seventy years ago. We have made a cursory examination of these letters side by side with Masson's well-known work, and the letters in Mr. Forrest's book appear to be identical in many respects, but there are improvements in the choice of phrases, descriptions, and so on in Masson's book, which lead one to think that the manuscript now reprinted may have been a sort of rough draft of the published work. Some of the names have been seriously mutilated. The village of Morad Ali is printed as Morally, and the well-known place Kohat appears throughout as Kivort. Moreover, the extracts would seem to have become mixed in some instances, so that they are not printed in their proper geographical and chronological places. There is no reference in the Introduction to Masson's letters, which occupy more space than almost any other contribution. The first paper in point of order is a translation of a French officer's itinerary from Yezd to Herat, and thence to Kabul in 1826. The well-known General Avitabile was a fellow-traveller of the French officer. The next is a report by Major D'Arcy Todd (who accompanied Mr. John McNeill, on his mission from Teheran to Herat) on a sixty days' journey from Herat to Simla in May to July, 1838. The route covers much of the same ground as that followed by the French officer referred to above. Then follows a short note on Herat and surrounding countries by Alexander Burnes. A narrative of a journey from Khelat to Sonmiani in November, 1839, from the pen of Captain J. Outram, follows, and this is succeeded by an account, in two parts, of an embassy to the King of Persia from the Amir of Kabul, written by Mahomed Hoosani Kashee, the Elchi, at the request of Captain Burnes. Several letters from Major D'Arcy Todd, dated in the early part of 1841, deal with the breaking off of our relations with Herat, and these are followed by some of Lieut. Pottinger's letters from Herat of somewhat older date, *i.e.* March, 1838.

We then pass on to Arabia. A report dated 1835 by Lieut. Wellsted, I.N., whose name may be recalled in connection with some notable marine-surveying work in the old *Palinurus*, contains a description of the ruins of Nakab-al-Hajar in the Wadi Meïfah in Southern Arabia. The conclusion of Lieut. Wellsted was that the ruins were magazines and forts erected during the Sabæan dynasty two thousand years ago, when the trade from India flowed through Arabia towards Egypt. There is also a short account of an excursion in Hadramaut by Baron Adolf Wrede, and a Memoir by Captain Haines, I.N., of the *Palinurus*, concerning his survey of part of the South Arabian coast from the entrance of the Red sea to Misenat. A rather longer paper by Mr. Charles Cruttenden, also of the Indian navy, furnishes a narrative of a journey from Mokha on the Red sea to Saná in Yemen in July and August, 1836. Most of these Arabian papers were originally

printed in the *Journal* of the Royal Geographical Society. The last paper in the volume is a lengthy record of a journey in 1841 to Shoa, in Southern Abyssinia, carried out under the command of Captain W. C. Harris of the Bombay engineers, who undertook the mission to the King of Shoa under the instructions of the Bombay Government. The narrative is apparently from the pen of Lieut. W. C. Barker of the Indian Navy. The Introduction prefixed to the volume contains a good many interesting details, but might advantageously have been compressed, the long extracts reprinted from the papers themselves being unnecessary.

C. E. D. B.

BORNEO.

'Quer durch Borneo: Ergebnisse seiner Reisen in den Jahren 1894, 1896–97 und 1898–1900.' Von Dr. A. W. Nieuwenhuis unter Mitarbeit von Dr. M. Nieuwenhuis, von Üxküll-Güldenbrandt. Zweiter Teil, mit 73 Tafeln in Lichtdruck und 18 Tafeln in Farbendruck. Leiden: E. J. Brill. 1907. Pp. i.–xiii., 1–557. *Price* 19*s*.

An apology is due for delay in noticing the second volume of the valuable monograph by Dr. A. W. Nieuwenhuis on the ethnography of the interior of Netherlands Borneo, which delay, however, is not due to any lack of appreciation. In bringing his labours to a conclusion the author has presented us with the best original contribution to a knowledge of the ethnography of the fascinating people who dwell in the interior of Borneo. In another publication the indigenous population is divided into (1) the nomadic hunters, Punans, Beketans, Bukits; (2) the Bahau-Kenya-Kayan group in the north and east; (3) the Ulu Ayar or Ot Danum in the south. The jungle hunters are a fairly uniform, low brachycephalic group, the cephalic index in the living varying from 77–86, with an average of 82; they may very well be regarded as representatives of the original inhabitants. The Ulu Ayar are essentially dolichocephalic, with a preponderance of indices at 74 in the living, but ranging from 71 to 81. Their skin is darker than that of the other peoples, and Dr. Nieuwenhuis states that he sees no reason why they should not be of Indonesian stock. The Muruts of Sarawak are evidently an allied people. Of the third group only Kayans were measured; their head indices varied from 68 to 97, with maxima at 78 and 80; they are thus a mixed race. A summary of recent measurements of the interior peoples of Borneo will be found in *Man*, 1905, No. 13. In his first volume, the author (cf. *Geographical Journal*, vol. 25, February, 1905, p. 202) dealt more particularly with the Kayans, but made interesting comparisons, especially in their decorative art and tattooing, with other tribes. The district of the middle Mahakam (*i.e.* between the western waterfalls and Udju Tepu, including the eastern falls) is inhabited by numerous small groups, almost all of which remember their migration from the high-lying home of their race, Apu (highlands) Kajan (Kayan,) whence they were ejected by the increasing pressure of the population. They all occupy the main river, though a few have settled on the tributaries, the sources of which are visited by the Punans. These Bahau-Kenya peoples have formed the inhabitants of the Mahakam district for centuries, the latest arrivals from Apu Kajan being the Long-Glat, at the end of the eighteenth century. This tribe has met the fate of all who have wandered into the lowlands from the highlands, suffering more than in their isolated mountain country from malaria and infectious diseases, such as cholera, small-pox, etc., contracted from the coast, losing in numbers and health, and the process of degeneration is already far advanced among the many groups on the middle Mahakam. While the dwellers in the mountains seldom suffer hunger, thanks to their industry, it is a frequent visitor in the lower regions, and much foreign rice has to be imported. The presence of foreigners in this district also contributes to degeneration. The Bugi and Kutei

pressed in from the lower Mahakam after the bush products were exhausted to exploit the untouched forests of the middle Mahakam. This incursion of outsiders first occurred after the Bahau chiefs had come more and more under the influence of the Kutei Sultanate, and the traders found more protection. But the Bahau of the upper Mahakam have found a natural protection in the rapids and waterfalls against the influence of the coast Malays, who trade with the middle Mahakam, while dwellers on the latter seek the markets of the coast. Their original manners and customs suffer less from the contact than their health and welfare, which is frequently affected by the worse climate and hygienic conditions, and also by gaming, cock-fighting, and betting. For example, bark cloth is almost entirely discarded, being superseded even in mourning by white or light brown cottons. The families of chiefs who have adopted Islam dress in Malay fashion, and even the chiefs who remain heathen, find Malay fashions more suitable to their rank than native costume. As for their agriculture, which is the main occupation of the inhabitants, very little primæval forest is felled, the Bahau contenting themselves, like the Malays, with cutting down under-brush and young trees, because the work is easier. Later, however, the weeding in these fields takes more time and trouble than was originally saved. The gulf fixed between the free men and slaves is very clearly marked, and inter-marriage firmly discouraged. The slaves are well treated, and neither sold nor put to death, but few attain to positions of influence; and none may possess any land save a small piece next to the chief's fields, which is necessary for their sustenance. The gulf between the chief and the free men is necessarily bridged over by the exigencies of polygyny. The polygyny of the chiefs is attributed to Malay influence, as it was not customary in early times. Another modern custom is the betrothal of young girls almost as soon as they are born; this results in premature marriage and child-mothers. Among the Bahau of the Mendalam the women play an important part, are consulted in all affairs, and in many respects enjoy greater privileges than the men; but in the Makalam they have a subordinate position, and are not consulted by the men. The superiority of the position of the former is doubtless due to the fact that the men undertake very long trading journeys. Serious quarrels do not occur among the Bahau; the compounding of offences by law-breakers or enemies, even the expiation of murder itself, is preferably by fine. Human sacrifice is due to religious conviction and love for the dead. They are under-developed and cowardly rather than revengeful, bloodthirsty, and brave. Their expression for fearless courage is characteristic; they call it "stupid courage." Truth is disregarded; they are shameless and inveterate beggars, but not thieves. The ties between parents and children are very close and tender, the children being generally spoilt and often tyrannical. Only the souls of those who have met a sudden death are feared. The fact that Borneo, especially Central Borneo, is so thinly populated has been attributed to various causes, such as internal warfare, wandering habits, etc.; but these cannot apply to the Bahau or the Kenya, where all conditions of life seem favourable. But the people are too ignorant to take advantage of the favourable or to avoid the unfavourable conditions, and they fall victims to various diseases against which they have no remedy save charms. Diseases such as malaria and small-pox (which has been known to carry off one-third of the whole population of a settlement) are not only fatal in decimating the population, but also in enervating the remainder, and to this the backwardness and ignorance are probably due. The methods of agriculture and of hunting are primitive, arduous, and unprofitable, and fear of punishment by spirits hinders all innovation and experiment. At the same time the Bahau show good mental ability; many can speak several dialects, and learn them without apparent difficulty. They exhibit considerable mechanical skill and a

most admirable artistic feeling and dexterity. The daily life, technology, and art-work of the Bahau are fully described and most abundantly and beautifully illustrated.

A. C. HADDON.

CERAM.

'Het Eiland Seran en sijne Bewoners.' Door F. J. P. Sachse, Kapt. der Inf^e., O.L.L. Boekhandel en Drukkerij v/h E. J. Brill, Leiden. 1907. Pp. 184. *Price* Fl.3.50.

The island Ceram, as it is generally though incorrectly spelt, has not hitherto been thoroughly explored, for the interior consists, especially in the west, of mountainous country clothed with dense forests and peopled by savages who are by no means well disposed towards Europeans. Being civil commissioner in the island during four years when the Government decided to negotiate directly with the natives of the interior, Captain Sachse had unusual opportunities of making acquaintance with the remote parts of the island and its inhabitants. In a short sketch of the geography, the author reports that the central chain does not run the whole length of the island, as has been stated, but only from the Gunung Dibaban to the Hatu Walokoné group. The Wallace mountains are a separate group, connected by a rather flat undulation with the spurs of the Hatu Walokoné. The highest summit is the Merkélé, about 6200 feet, though on some maps it appears as the G. Mansela with a height of 6500 feet and more. The inhabitants, to whom a large part of the work is devoted, are Alfurs, but on the coast mixed with strangers—Javanese, Makassarese, and Malays. Probably Van Hoëvell's estimate of their number, 63,487, is nearest the truth. The Alfurs of West Ceram are well built and of a fairly tall stature, while those in the middle of the island are smaller, averaging nearly 5 feet. Most of them have no religious beliefs, but a kind of ancestor worship prevails among a few tribes. The most distinctive ceremony is the initiation into the Kakihan brotherhood, of which Captain Sachse gives no explanation, but states that at the present time, at any rate, it has no political signification. Perhaps it merely marks the attainment of manhood, which seems to be further indicated by the duty imposed on the youths after the ceremony of going head-hunting. In many respects the Alfurs of the interior are superior to those on the coast, and many other natives of the eastern archipelago. Their great vice is drunkenness.

Captain Sachse describes the customs both of the mountain Alfurs and the mixed peoples of the coast, and gives an outline of the history of the Dutch proceedings in the Moluccas from the time of their first appearance in the group in the year 1599. A sketch-map of Ceram is appended, and Prof. K. Martin has contributed an introduction.

KOZLOF'S CENTRAL ASIAN EXPEDITION OF 1899–1901.

'Mongolia i Kam. Trudi Ekspeditsii Imperatorskavo Russkavo Geographicheskavo Obshchestva soversheno v' 1899–1901 gg. pot rukovodstvom P. K. Kozlova.' Tom. II. part i., A. N. Kaznakof, "Moi Puti po Mongolii i Kamu." Tom. III. part i., N. A. Tachalof, "Astronomicheskiya Nabliudeniya P. K. Kozlova." Tom. V, V. Bianchi, "Aves Expeditionis P. K. Kozlowi 1899–1901." St. Petersburg: 1907. Pp. 135, 20, 251.

In the notice of Kozlof's narrative (vol. 1) in vol. **28** of the *Journal*, p. 626, mention was made of excursions made by MM. Kaznakof and Ladigin with the object of broadening the belt of reconnaissance. Vol. **2**, part i. contains an account by M. Kaznakof of the chief of his journeys. From the Russo-Chinese frontier at the Ulan-daba pass Kaznakof left the main expedition for the Kobdo river, from which he crossed to the Saksai, and rejoined Kozlof at Kobdo. The Dolmo lakes,

from which the Kobdo flows, were sounded, and the upper, about 17 miles long, with a maximum breadth of 4 miles, was found to have a maximum depth of 124 feet. Another excursion was commenced at the Khulmu-nor, and the southern flank of the Altai was explored, while Kozlof followed the northern flank. The Tsagan-nor which appears on many maps could not be found, but only a small lake was seen in this neighbourhood—the Khutuk-nor, about 20 miles in circumference. The Ulan-nor, seen from a distance, was in that year quite dry. Kaznakof also made a separate journey across the Gobi, visiting the lakes into which the Edzin-gol pours its waters through several channels, and passing through Fu-ma-fu and Lian-chow (Er-chow), and a short excursion in the valley of the Da-chu.

In the second of the volumes noted above the latitudes and longitudes of thirty-seven points are worked out by M. Tachalof from Kozlof's very carefully executed observations, and maps show the exact positions of those points and bearings taken from them.

The ornithological collection consisted of fifteen hundred skins, twenty-two eggs, five nests, and three skeletons. Especially interesting are the specimens from Kham. They include several new species and a new genus (Kaznakowia) of the Crateropodidæ family. Other forms are now described for the first time by Prof. Bianchi.

W. A. T.

AFRICA.

The Peninsula of Sinai.

'The Topography and Geology of the Peninsula of Sinai (South-Eastern Portion).' By Dr. W. F. Hume, D.Sc., A.R.S.M., Superintendent of the Geological Survey of Egypt, Survey Department, Egypt. Cairo: 1906. 8vo, 280 pp.; 18 plates of photographs, 1 topographical and 4 geological coloured maps, and 1 plate with transverse sections.

'The Topography and Geology of the Peninsula of Sinai (Western Portion).' By the late T. Barron, A.R.C.S., Survey Department, Egypt. Cairo: 1907. 8vo, 241 pp.; 8 plates of photographs, 1 topographical and 1 geological coloured map, and 5 plates with transverse sections.

The peninsula of Sinai will doubtless always attract the attention of geographers, for it bears on many problems of enduring interest, from the early wanderings of the Israelites to modern speculations on climatic change, and the origin of the East African rift-valleys. In spite of its accessibility it has remained comparatively little known, owing to its extreme topographic complexity, and its arid climate; and perhaps also to idle fears of the scanty but apparently friendly natives. Most of us have learnt most of what we know of Sinai from the Pentateuch, and one naturally first inquires of these memoirs whether there is any evidence of the supposed increasing desiccation of the lands bordering the Eastern Mediterranean. Moses' accounts of the deserts of Sinai, however, indicate that there has been no serious change since his time; indeed, the experiences of Hume and Barron suggest either that the country has more water to-day, or that they were more expert in their search for it. "Except in the coast plain between Suez and Wadi Gharandel, and the range of El Araba and Qa Plain," says Barron (p. 92), "water-supply need cause no anxiety to the traveller." The valleys in the winter are swept by heavy floods. There is water in nearly every main wadi, and in many of the side ones; there are large perennial pools, and often streams which run all the year, leaping down the cliffs in waterfalls, bordered by rich growths of maidenhair fern. In the winter rain was so frequent as to be a nuisance, and there was occasional snow. Nevertheless, the mountain massif is so deeply intersected by valleys, and so well drained, that the general impression of the whole

area is that of a rocky desert, and, to use Dr. Hume's words, "in many places . . . unmitigated desolation holds sway." The scenery is described as often grand and beautiful. The rocks are majestic and richly coloured, and the valleys contain oases described as of extreme beauty after the winter rains, being "in many places a veritable garden of flowers."

The Sinai peninsula is one geographical unit, and the reports by Dr. Hume and Mr. Barron agree as to its essential structure. It consists of a massif of crystalline and schistose rocks, including many granites and their metamorphic aureoles, which are fully described by Dr. Hume. The altered rocks include limestones and various foliated sediments. The age of these rocks is not definitely established. They are the oldest rocks in the peninsula, and are certainly pre-Carboniferous. Mr. Barron described them as post-Archean, and probably Lower Palæozoic, but the evidence for this view is not convincing, and they may be Archean. The oldest fossiliferous rocks belong to the Carboniferous, and they are succeeded by Cretaceous, represented by Cenomanian and Neocomian series. The Cretaceous beds are the Nubian Sandstone, which has been generally regarded as aëolian in origin; but the authors both hold that it is aqueous. Dr. Hume describes it as a shallow-water marine formation, and Mr. Barron as fluvio-marine. The Eocene system is well represented by each of its three series: the uppermost or Bartonian series was recognized by Mr. F. Chapman from the Foraminifera, and his identification has been confirmed by the stratigraphical evidence. Miocene beds were discovered by Bauerman in 1868, and some beds which are probably Pliocene are described by Barron. The most important Pleistocene beds are some lake deposits among the mountains, some oolitic sandstones, which, if marine, prove a Pleistocene uplift of about 2300 feet, and an interesting double series of raised coral reefs, which are well described by Dr. Hume. Most of the fossils recorded have been determined by Mr. R. B. Newton.

The present topography of the area is due in the main to vertical movements along faults. The crystalline central massif of Sinai has been left as a horst (rising in Jebil Zebir to the height of 8551 feet, and in Jebel Musa, the mountain of Moses, to 7519 feet), while the surrounding country has foundered, forming the rift-valleys of the gulfs of Akaba and Suez. The fundamental importance of fault action is shown by both Dr. Hume and Mr. Barron. The movements were of great extent: thus, the fault which has dropped the sedimentary rocks of the coastal region against the crystalline horst of Sinai had a throw, according to Dr. Hume, of 15,000 feet, and the date of this great movement was so recent as the Upper Pliocene.

The earth-movements have also determined many of the chief topographical features of the land, including the position and trend of the valleys; numerous rift-valleys run parallel to the Gulf of Suez, and Dr. Hume gives a clear description of one, the Shelala um Raiyig, which is 72 kilometres long. "The main features of the Sinai peninsula," says Dr. Hume (p. 37), "have been produced by dislocation rather than erosion, fracture in three directions, either directly proved or in the highest degree probable, having determined the general structure of the country."

The economic geology is fully considered in both reports. The most interesting product is the turquoise, which is found in veins in faulted parts of the Carboniferous sandstone, and is worked by the Bedawin. There are many ore deposits of manganese, which Mr. Barron estimated may be worked at a profit. He also quoted the Nubian Sandstone and the granite as among the economic resources of the country, but Dr. Hume remarks that they have no value under existing conditions.

Both authors describe briefly the fauna and flora of the country. Animal life is

scanty, the ibex, leopard, and wolves being the most important mammals. Dr. Hume has an interesting comparison of the vegetation of Sinai with that of the eastern desert of Egypt, and describes the streaming of the plateau flora along the rift-valleys into the central mountains.

The two memoirs give full reference to previous work on Sinai, and they are illustrated by a series of excellent photographs and maps. They form a most important addition to knowledge of this neglected area. Mr. Barron's work is, alas! his last; his death in the Sudan has cut short a useful and most promising career.

J. W. G.

German South-West Africa.

'Deutsche Kolonialwirtschaft.' I. Band: Südwest Africa. By Dr. Paul Rohrbach. Berlin: 1907. Pp. viii. + 510. *Price* 10 *m.*

This is the first of a series of volumes which the author intends to devote to a comprehensive study of the German colonies from the purely economic standpoint. It is entirely occupied with German South-West Africa, and its special aim is to determine how far this not very inviting region is suitable for European settlement. The information embodied in the text, and the conclusions arrived at are the result of a three years' residence on the spot (1903–05) as director of a commission appointed to inquire into this and allied subjects. Owing to the outbreak of the Herero and Nama revolts, the practical question of European settlement had to be shelved for the present, and this, followed by profound differences from the authorities on some fundamental points brought about the resignation of Dr. Rohrbach, who "returned to Germany and withdrew from the colonial service." He thus secured the leisure necessary to make a calm survey of the whole situation, and give permanent expression to the conclusions he has arrived at, so far as regards the special physical and social relations prevalent in South Africa.

With the general inference that this arid or steppe region is valuable only for stock-breeding and a little market-gardening in a few favoured districts, most competent observers will fully agree. Assent will also be given to the remark that the opening up of the country, as distinct from its military occupation, must remain a purely academic question until ample provision is made for railways and other means of communication beyond the private resources of the pioneer settlers, already burdened and over-burdened with the special difficulties of an unfavourable climate and not too fertile soil. The author passes severe strictures on the "privileged associations," which, he is of opinion, should either be absolutely suppressed or else strictly compelled to comply with the expressed or implied terms of their concessions. The capital, for instance, which was promised to improve the land and prepare it for occupation, has not been advanced to any great extent, so that the associations have become obstacles rather than helps for the development of the protectorate. The tacit or avowed policy has been to do nothing until the value of the concessions has been enhanced by the indirect action of the Government measures undertaken for military and other purposes. Some judicious remarks, which will equally apply to the neighbouring British territories, are also made regarding the vital question of irrigation, showing that to buy or rent Crown lands in South Africa, and then go in quest of water, is to court failure.

But when Dr. Rohrbach comes to speak of the policy to be pursued towards the missionaries and the aborigines, he makes suggestions which will scarcely be taken seriously. "For the present," he writes, "there can be no doubt that for the treatment of our natives in South Africa, what is required is the Boer system" of apprenticeship, and that the missionaries are to be allowed a free hand only on

the express condition that their pupils be taught "no reading and writing that might lead to an understanding of any literary European tongue."

A. H. K.

Eritrea.

'In Africa: Lettere dall' Eritrea.' Parte Prima. "Lungo l'Anseba e sull' altipiano Abissino." By Giotto Dainelli. *With* 152 *Illustrations.* Bergamo: 1908.

This volume forms one of a series of monographs issued by the *Istituto d'Arti Grafiche* of Bergamo, and dealing with travels in various parts of the world. The author and three friends visited Asmara in 1905–06, for the purpose of attending the Colonial Congress at that place. But while most of those who took part in the Congress returned home after a very brief sojourn in Eritrea, Dainelli and his friends travelled from one end of the colony to the other. It was arranged that ethnography, geology, and geography should be properly looked after, and observations recorded by each member of the party. But we are bound to say that there are very few observations of a comprehensive or detailed character recorded in the pages of the present work. It consists of letters written at short intervals from the various halting places *en route*, and though the incidents of travel are told pleasantly enough, there is no attempt at an elaboration of the subject, which would convey an exhaustive idea of the country and its possibilities, or of the economic or other success that has so far attended this Italian experiment in colonization. We presume, however, there may be another volume forthcoming, dealing with the concluding part of the tour. From a descriptive point of view the present work is good enough, and its value in this respect is certainly enhanced by admirable printing of the photographic views. Small as they are, they are reproduced with great clearness on excellent paper, a feature due, no doubt, to the artistic resources of the Institute under whose auspices the work is produced.

AMERICA.

The Mystery of the Pilcomayo.

'The River Pilcomayo from its Discharge into the River Paraguay to Parallel 22° S.' By Gunnar Lange. Buenos Aires: Press of the Argentine Meteorological Office. 1906.

From its first discovery the Pilcomayo has been regarded as a possible means of communication between the mining region of Bolivia and the great waterways of the Argentine. Gathering its waters from the mountains of south-eastern Bolivia, it enters the great central plain of South America as a majestic river, and it is as a broad navigable stream that it unites its forces with the Paraguay: but every attempt to follow its course between these points has been foiled by the great morass, the Estero Patiño, which interrupts its course for some 50 miles, where even in the rainy season there is insufficient water to float the shallowest craft.

The author ascended the river when it was exceptionally low, and worked in connection with a land detachment, which marched at a little distance from the right bank. He found a large portion of the swamp sufficiently firm to enable him to explore it on foot. Ultimately, dragging his boats through stretches of shallow water and over intervening tracts of dry ground, he reached the upper river, and continued his journey as far as the point where the river ceases to form the Argentine frontier with Bolivia. He has embodied the result of his survey in seven maps on a scale of 1:100,000 (1·58 miles to the inch), and a general map of 1:600,000 (9·47 miles to the inch), with numerous transverse and longitudinal sections. He has thus enabled us to follow the fortunes of the Pilcomayo from

22° S. lat., only 50 miles below the point where, after traversing a narrow gorge in the Serrania de Caiza, it leaves the mountains behind, to its union with the Paraguay, a distance of nearly 400 miles in a direct line, and about 680 following its course. During the first 176 miles it wanders in numerous meanders within the limits of its valley. The alluvium then loses its sandy character, and at the same time the river takes a more direct course. Though it is often nearly level with the plain, there are stretches where the banks are higher and rapids are met with. In many places marshy ground and sheets of water occur, but these do not assume especial importance above the junction with the Soret Satandi, 350 miles below the highest point of the survey, corresponding to a direct distance of 216 miles, during which the river has fallen 460 feet. It has at the same time diminished in volume and size of channel, having received no true affluents since it left the mountains, and any contributions from local rains being more than counterbalanced by the loss from evaporation, and overflow and leakage into the adjoining country, which is often lower than the river-level. It is flanked on the south-west by subsidiary streams draining the swamps and lagoons, which are mainly found on that side. One of these streams is the Soret Satandi. Further off, and of much greater length and importance, is the Tala or Dorado, which flows at a somewhat lower level. This carries little water, though it has a wide channel, and the Indians state that it represents the former bed of the Pilcomayo that was blocked up in a great flood.

Below the junction with the Soret Satandi, the Pilcomayo flows north-eastward into a succession of lagoons, whose low shores covered with the "totora" (*Typha dominguensis*), a tall rush-like plant, are only broken by narrow channels, which at a short distance become merged in the marsh. What now becomes of the river is not exactly known, as the country immediately to the south-east is still unexplored, but some 35 miles away in that direction a small stream was discovered by Lieut. Olaf Storm in 1890, and identified by him with the Pilcomayo. It soon disappears, but 1½ miles further to the south-east emerges in a number of branches, which soon coalesce, and their united waters, gathering volume as they flow, reach, after a course of 6 miles, the low falls called the Salto Palmares by Storm, who navigated his small stern-wheel steamer up to this point, and then, transporting it overland past the falls, managed to take it 2 or 3 miles further (*Geog. Journ.*, vol. 7, p. 82 (1896)). The author found that the falls had travelled several hundred yards up-stream since they were first examined. Some 10 or 12 miles lower down the river has increased in size, but is still very small compared with the Pilcomayo before it entered the lagoons. It now unites with the Dorado, which appears to be usually somewhat larger in volume.

It was up the latter stream that Lange made his way, ultimately transporting his boats to the upper Pilcomayo by way of the Soret Satandi. From the neighbourhood of the latter the Dorado pursues a tortuous course to the south-east, sometimes flowing sluggishly in a broad channel, sometimes disappearing altogether. It finally reaches the light of day in a number of circular springs referred to as "well eyes," at the head of narrow channels some 9 feet below the surface of the marsh. These speedily unite, and the Dorado is thus reconstituted 3 or 4 miles above its confluence with the Pilcomayo.

From the Soret Satandi to the neighbourhood of the "well eyes" the marsh is nearly level, there being a fall of only about 16 feet in a direct distance of 55 miles. There is then a comparatively steep descent,* with frequent rapids, which continue to a point 49 miles below the junction of the Dorado and Pilcomayo. Thence the river follows a nearly horizontal winding course for 188 miles to its confluence with the Paraguay.

* In a direct distance of 25 miles the fall is more than 150 feet.

Wherever in the Estero Patiño a stream has removed the surface deposits a hard bed of carbonate of lime ("tosca") is laid bare, and the same rock is exposed in the rapids below. The author believes that this rock is impervious, and that the water makes its way through the under portion of the marsh. It is, however, probable that it has made channels for itself through the limestone, which would seem to represent the escarpment of calcareous strata dipping gently to the westward.

The waters of the Dorado and Pilcomayo, where they reunite, account for only a small portion of the volume of the upper Pilcomayo, some of which, no doubt, finds its way to the Fontana, which joins the Pilcomayo about 122 miles above its mouth, and of the remainder, what is not lost in evaporation apparently helps to feed the neighbouring affluents of the Paraguay.

The author made observations for latitude at the most important points, and these agree with those of Lieut. Storm.

J. W. E.

AUSTRALASIA.

Early Enterprise in Queensland.

'The Discovery and Settlement of Port Mackay, Queensland.' By H. Ling Roth. Halifax: F. King & Sons. 1908. *Maps and Illustrations. Price* 10*s.* 6*d. net.*

Mr. Ling Roth, who was at one time Honorary Secretary of the Mackay Planters' and Farmers' Association, supplies in this book a most interesting chapter in the history of early Australian enterprise, and one which will be in great part new to most of his readers. His former connection with the district of which he treats has given him special facilities for ascertaining the facts of the story, and the knowledge thus gained at first hand has been supplemented by painstaking research into such literature as might help to elucidate obscure or doubtful points.

In the opening chapters the author sketches, first, the early discoveries on the east coast of Australia between 1770 and 1844, beginning, of course, with the work of Captain Cook, whose chart of this part of the coast he reproduces side by side with one of the same coast as shown by the latest surveys; secondly, the exploration of the same region by land from 1813 to 1846; and thirdly, the exploration both on the coast and inland, 1847 to 1859. In these chapters, especially the two latter, much persevering enterprise on the part of the early pioneers is rescued from oblivion, many of the names being, perhaps, little known to the world at large, though the bearers of them played their part none the less effectually in the building up of a white man's country in that remote part of the world.

Summing up the results of all the discoveries down to 1859, Mr. Ling Roth points out that while the surrounding country had become more or less known, and was being rapidly settled, the immediate district of Port Mackay was not as yet dreamt of. Its discoverer was Captain John Mackay, who is naturally to some extent the central figure of the book, and whose expedition (the subject of Chapter IV.) deserves to be somewhat particularly referred to. Leaving the gold-diggings, Mackay set out with a party in January, 1860, in search of new grazing lands. Travelling northwards between Isaacs river and Broad sound, and suffering on the dreary way much distress and sickness, they camped on May 15 at a spot in 21° 14′ S., 148° 22′ E., and looking thence eastwards from the top of a mountain beheld an immense level country stretching away to the coast. Two days later they came to a creek with a good supply of water, and next day to its junction with a large creek from the south, whence it flowed northwards, a deep river, to which they gave the name of Mackay river. The name Mackay having,

however, been already appropriated to a stream flowing into Rockingham bay, the name of the more southern river was in 1862 changed to that of Pioneer. The town then being surveyed on its banks was, in justice to the discoverer, named Mackay. The narrative of this important expedition is derived from Mackay's own journal, which was given to Mr. Ling Roth by its writer when on a visit to Port Mackay in 1882. The expedition yielding him no pecuniary profit, Mackay returned to his sea-calling, and for twenty years was the respected commander of various vessels in the South sea and New Zealand trade.

In the latter part of the book the progress of settlement is traced down to 1867, from which year already existing records may be said to begin. There are also notes on the natural history of the district, while the volume is illustrated by reproductions of portraits, maps, and views. Copious footnotes explain obscure points, and altogether the book represents a valuable piece of research.

GENERAL.

Cosmogony.

'Worlds in the Making: The Evolution of the Universe.' By Svante Arrhenius. Translated by Dr. H. Borns. Pp. xiv. + 230; 60 *illustrations in the text*. London and New York: Harper & Brothers. 1908. *Price 5s. net.*

No one in modern times has done more to elucidate the problem of the universe and its physical explanation than Prof. Svante Arrhenius, who has now given us, in a collected form, the results of his work and speculation. He has carried forward the nebular theory by the recognition of the effect of radiation pressure; light and heat exert a definite, if small, pressure on all objects exposed to their rays, and this pressure may balance or even exceed the effect of gravity. In the case of our sun all particles of less than 0·0015 mm., or a little less than one-thousandth of an inch in diameter, are driven off into space, where, as they come into contact with other bodies, they aggregate into meteorites; or, reaching the outer layers of gaseous nebulæ, gradually form a coating, which, contracting on to the central portion, leads to a rise in temperature and the formation of stars and suns. These, ultimately, cool down on the surface, acquire a solid crust, surrounding and confining masses of highly heated and compressed gas, and float through space like gigantic bombs, till at last a collision takes place, the outer crust is fractured, the interior explodes and scatters through space to form once more a gaseous nebula; and so the universe continues in an eternal cycle, without beginning and without an end, in which life may exist for ever and undiminished. The transference of life from worlds which cease to be fit for its support to those which are reaching an appropriate condition, is provided for by the radiation pressure, which can drive minute spores, carried into the upper layers of the atmosphere by air currents, away into space, through which they travel till, ultimately, some reach a world where they can develop and start again the cycle of life, as it was started in our own world.

The system is complete—too complete, indeed, to be generally acceptable as a final explanation of the universe—but, though we cannot follow Prof. Arrhenius in his metaphysics, there can be no question of the value of his physical work, and of the service he has rendered in making its results generally accessible. For the most part these results do not directly affect geography, but his speculations regarding the nature of volcanic and seismic activity, and of the origin of the northern lights are not without geographical interest, while his demonstration of the climatic effect of small changes in the composition of the atmosphere is of special importance. According to his calculations, a doubling of the proportion of carbonic acid in the air, which amounts to about one-third of 1 per cent., would raise the mean

ROUGH SKETCH MAP OF Dr SVEN

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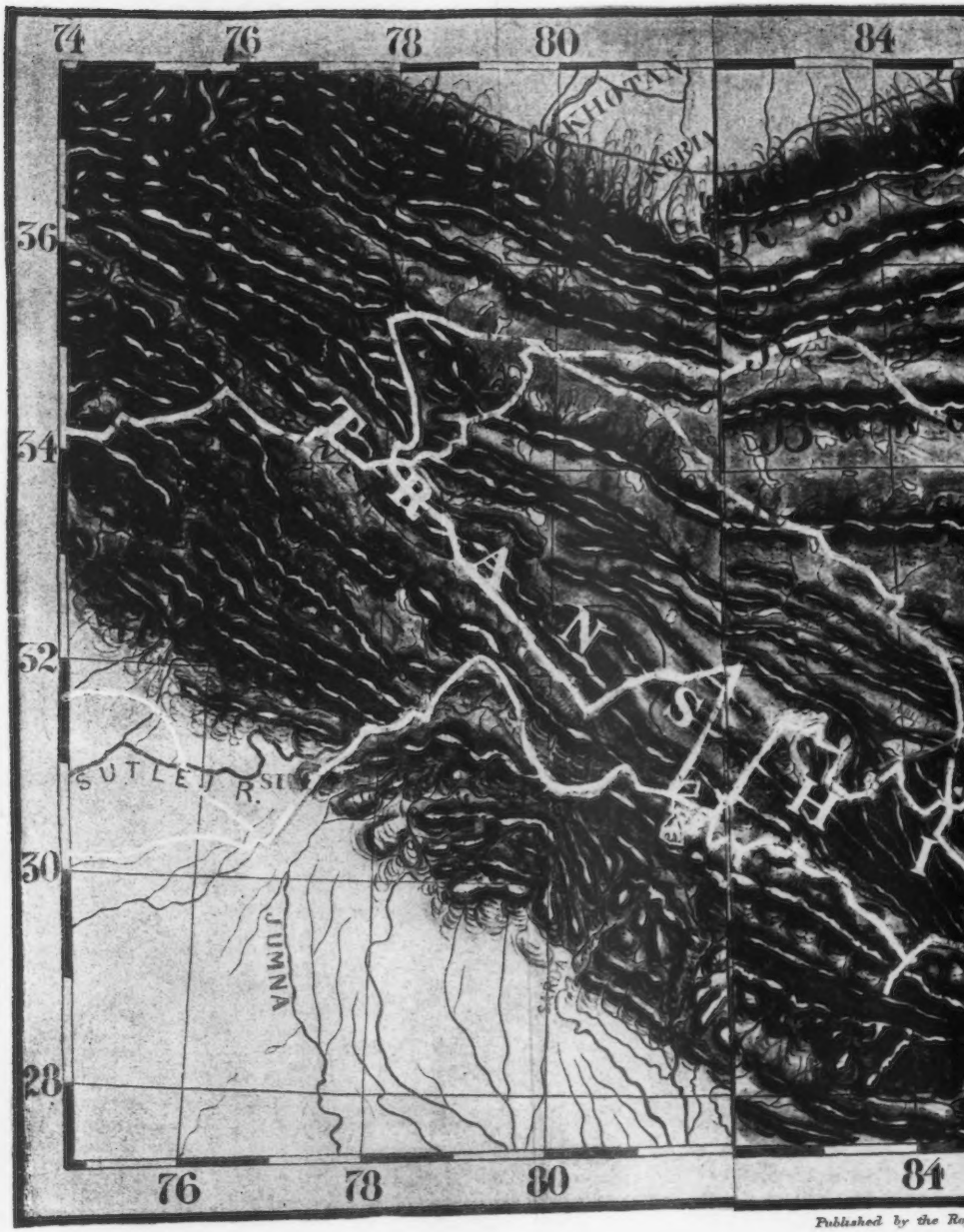

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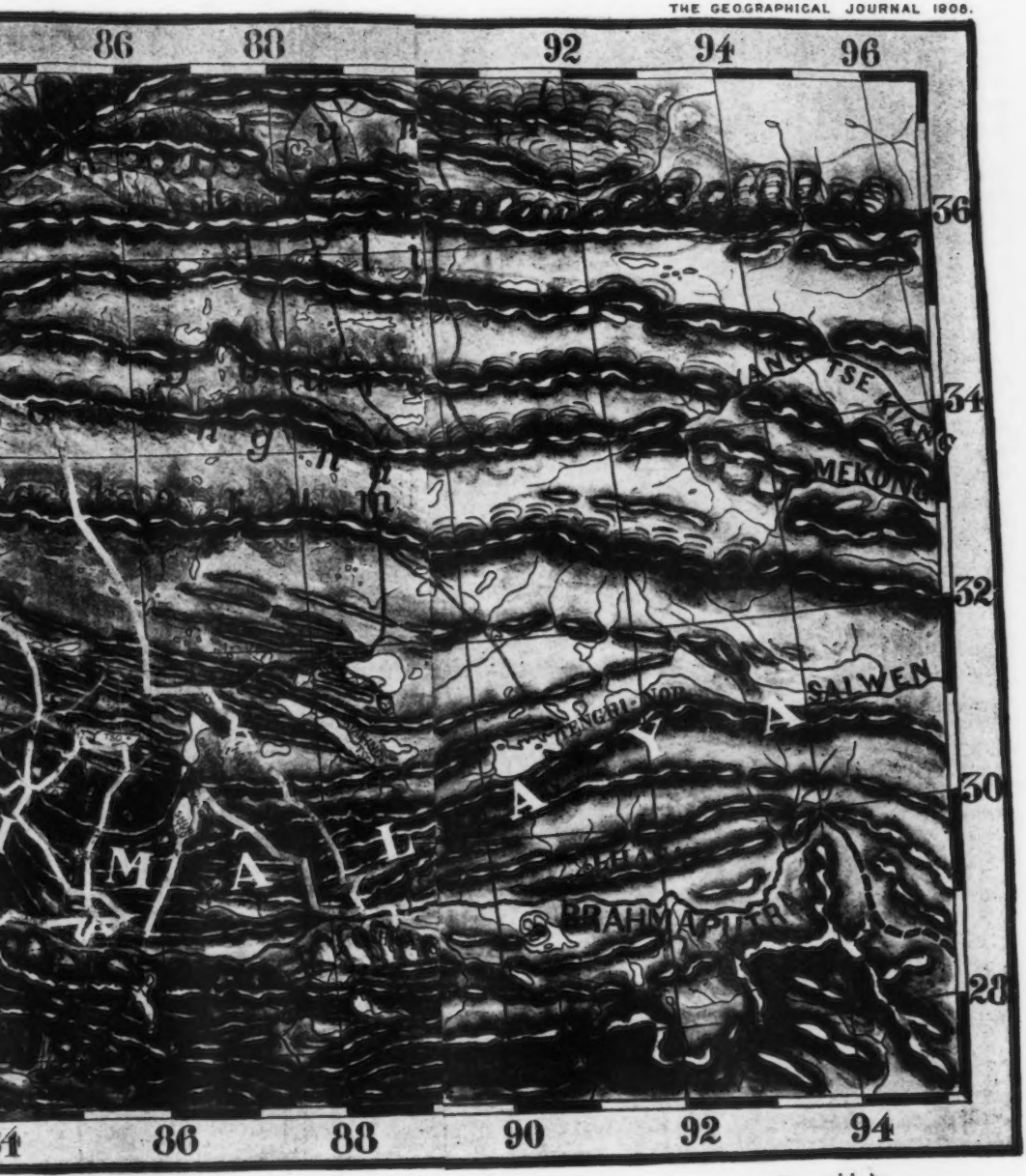

he Royal Geographical Society.

Sven Hedin
Simla. Sept. 1908

temperature by 4° C., and the greater proportion of water-vapour which the air would hold, in consequence of its increased temperature, would lead to a further rise of about the same amount. The coal consumed each year, at the present rate of consumption, is said to throw into the atmosphere one seven-hundredth part of its contents in carbonic acid, and, accepting Prof. Arrhenius' figures, we may calculate that this leads to a rise of the mean temperature of the Earth's surface by about one-fiftieth of a degree Fahrenheit, so that, while using up the available store of coal we are ameliorating climate and lessening our descendants' need for fuel.

R. D. O.

MAP OF DR. SVEN HEDIN'S RECENT JOURNEYS IN TIBET.

We give in the present number a facsimile reproduction of a rough map which Dr. Hedin has sent to the Society, showing his routes during his last two years' journeys in Tibet. The map is necessarily rough, and is probably a reduced copy of the diagram which Dr. Hedin used in connection with his lecture at the Viceroy's palace at Simla. It will at least show the very great extent of ground covered by his routes, and, by comparing it with the Society's map of Tibet, it will be seen that he has filled up the most important blanks which are there shown.

In a communication he says, "The whole white patch on your map of Tibet, where you have the fascinating word 'Unexplored,' I have been happy enough to fill out with mighty mountain ranges, lakes and rivers, temples, innumerable names, roads, etc. Most of it belongs to the province of Bongba—Doktol is a name nobody knows. You may wonder why Ryder and Rawling did not see the Trans-Himalaya; well, it cannot be seen from their route along the Sangpo and upper Indus. Their work in Tibet is, anyhow, perfectly splendid, and their map the best that ever has been drawn there. Of course, you will easily understand that the whole east and west parts of Trans-Himalaya were known before, but one-third of the range, or rather system, situated exactly where you have the word 'Unexplored' on the Society's map of Tibet, is absolutely new, and I have been able to show very clearly that the whole lot is one single system, and this discovery is, I dare say, the greatest I have ever made during all my journeys. The map enclosed shows where I have been."

THE MONTHLY RECORD.

THE SOCIETY.

Franco-British Exhibition.—Intimation has been received from the Commissioner-General of the Franco-British Exhibition that a diploma for Grand Prize has been awarded to the Society for its exhibits of maps under the group of Education, and another under the class of Mathematical and Scientific Instruments. Dr. Vaughan Cornish has been awarded a Grand Prize for his exhibit of photographs of wave forms of water, sand, snow, and cloud.

EUROPE.

The Fate of Prof. von Knebel.—The disaster to Prof. von Knebel's expedition to Iceland in 1907 was referred to in the *Journal* for October, 1907 (p. 436). In order to clear up the mystery attaching to the fate of the leader, his fiancée, Fräulein von Grumbkow, has this summer undertaken an expedition to the crater-lake of Askja, in company with the geologist Hans Reck, geological research being also meditated *en route*. The finding among the traveller's effects of a parcel of films dated some days later than the supposed date of the catastrophe seems to have given rise to the idea that the first accounts might have been incorrect, but Herr Spethmann has since explained that both the films and the writing on them were his own. A visit to the Askja lake was made early last summer by Herr Heinrich Erckes of Cologne (*Globus*, vol. 94, No. 10), who found no trace of Prof. von Knebel or his companion, but saw no reason to doubt that they had been drowned in the lake, possibly as a result of a fall of rock from its steep shores, instances of which he had himself more than once observed.

Jolivet's Map of Berry.—A copy of Jean Jolivet's map of the province of Berry, which, dedicated to Margaret of Navarre, Duchess of Berry, first appeared in 1545, has been brought to light, bound up in a set of maps mostly Italian, and dating from the sixteenth century. An article by Antoine Vacher in the *Bulletin de Géographie Historique et Descriptive* (1907, No. 2) gives an interesting and critical account of the map, including discussions of its methods of representing surface features, its location of places, its spelling of place-names, its relation to the geographical science of the time, its sources, and so forth. The volume containing the map belongs to the library of Paris University, as part of the foundation of the Jesuits' ancient library. On the fly-leaf is inscribed in writing, "Collegii parisiensis Claromontani Soc. Jesu." Originally separate, the map was sent by post to a Jesuit father. On the back, with form of address, are the words, "Au Révérend Père, Le Père Briet de la Comp^ie de Jésus. A Paris." The map, which is a copper engraving, measures 2·9 feet by 2·8 feet, and its six sheets are numbered in succession by the first six letters of the alphabet, beginning with the top left-hand sheet. None of the sheets, however, fits exactly with its neighbours. The ornamental frame contains, besides the map, accessory representations or commentaries, including an advertisement to the reader, dedication, indication of latitudes, a perspective of Bourges with explanation, types of ancient money of Bourges coined in the time of Lothair and Charles II., two notes concerning the extent of the diocese of Bourges and the method to be used for measuring distances, advertisement to the reader by Jacques Thiboust, who commissioned Jolivet to draw the map. The map is almost wholly confined to the diocese of Bourges, though it slightly encroaches on that of Nevers to the east, and on those of Clermont and Limoges to the south.

ASIA.

Prof. Musil's New Expedition.—Prof. Musil's explorations in Northern Arabia have been frequently referred to in the *Journal*. We learn from Vienna that this traveller set out during the past summer on a new expedition for which he had prepared himself by studies in astronomy, meteorology, and physical science. This time his objective is the little-known portion of the north Arabian desert, lying inland from Koweit between Babylonia, the Persian gulf, and the Hejaz railway. His intention is to execute a topographical survey and map of this tract, which is so rich in early historical associations, at the same time making a thorough study of its archæological and ethnographical features, including its inscriptions. The Turkish Government has shown its interest in the undertaking by granting to

Prof. Musil four firmans to the vilayets concerned, though the main objective of the expedition lies in independent Arabia. This is the eighth journey undertaken by the traveller, and it promises no less important results than any of the earlier ones. The cost is borne in part by the Austrian Government, in part by the Vienna Geographical Society and other bodies, as well as by private individuals. Its duration will probably be eighteen months. Prof. Musil reached Beyrouth, on his way to Damascus, in June last.

Expeditions in Eastern Central Asia.—The Russian papers are quoted in *Globus* (vol. **94**, No. 11) as announcing the receipt of news of Kozloff's Central Asian expedition (*Journal*, vol. **31**, p. 103). Nearly the whole of March and April were occupied in explorations in the deserts of Mongolia, while in July the proposed explorations in the basin of the Kuku-nor were to be begun. Some further details regarding the earlier stages of the expedition are given in the *Geographische Zeitschrift* (No. 9, 1908). Between Kiakhta and Urga the route of Obrucheff was followed. Here the surface features were very complicated, and no connection could be traced between structure and topography. This was also the case along the next section of the route, which led by the Tuku-nor, along the dry bed of the Onghin-gol, and across a part of the Mongolian Altai. Marine deposits connected with the old Han-hai sea were found to attain a thickness, in places, of over 600 feet. News has also been received of the arrival of the French traveller, Captain D'Ollone, at Lau-chou, which he seems to have reached from Cheng-tu *viâ* Sun-pan-ting. The announcement is made in the *Zeitschrift* of the Berlin Geographical Society of the departure of a member of that Society, Dr. Brunhuber, on an expedition for the exploration of the middle course of the Salwin. His proposed route would seem to be largely identical with that of the expedition of Messrs. Litton and Forrest lately described in the *Journal*.

The Volcano Islands south of Japan.—An interesting account of the group of small islands known by the above name, which lies south-south-west of the Bonin group, and forms one of the most southerly parts of the Japanese empire, is given by Mr. T. Wakimizu in the publications of the Earthquake Investigation Committee (No. 22*c*, Tokyo, 1908). The occasion of his visit to these islands (in Japanese "Iwojima"—a translation of the "Sulphur island" of Captain Gore, the discoverer of the largest of the group), was the report of the formation of a new island near its southern end at the close of 1904. Proceeding thither in June, 1905, for the purpose of examining the island, he found to his disappointment that the greater part had already been worn away by the waves, only a low reef, on which it was impossible to land, remaining above the water. He, however, obtained an account of its appearance and a report of its examination, earlier in the year, by some of the inhabitants of the main Iwojima, while his study of the other volcanic islands of this little known group has supplied some interesting information. The most northerly island, Kita Iwojima (or San Alessandro), is an elliptical mass rising steeply from the water (in the higher southern peak) to a height of 2534 feet. It is surrounded by a submerged platform, marking the space conquered by the sea by wave-action since the island was formed. The greater part seems to be composed of a comparatively hard volcanic agglomerate, containing a lava sheet. Most of the island is covered by a wind-swept forest, and there are no traces of recent activity. In 1899 a settlement was for the first time formed on it by Mr. Ishino. The largest island, Iwojima proper (also now inhabited), is like a gourd in shape, a low neck uniting the main mass—the low tuff-volcano Motoyama—with a cone-shaped volcano named the Pipe. The former is only 430 feet high, and the tuff bears traces of the action of the sea. This fact, together with the discovery by Mr.

Wakimizu of raised coral reefs bearing very little mark of weathering, justify the conclusion that the island is quite a recent formation, while there are indications that the land is still rising. The Pipe differs from Motoyama in all respects, being composed of stratified ash layers and lava sheets. The southernmost island, Minami-Iwojima or San Augustino, is a volcanic cone 3039 feet high. Its outline is almost circular, and the sides slope almost precipitously to the sea. It is imperfectly known, and the summit is almost constantly veiled in clouds. The island which appeared in 1904 lay 3 nautical miles north-east of Minami-Iwojima. A noise like the roaring of a cannon was first heard, and was followed by a column of smoke which changed in colour from black to white and red. The island was first distinguished on December 5, coming fully into view only on the 12th, for some time after which its shape was constantly changing. According to the report of its explorers, it was at first egg-shaped, the highest point, 480 feet above the sea, lying close to the larger end. Here it formed a precipice, at the foot of which lay a pond which Mr. Wakimizu regards as having been the centre of eruption. Explosion seems to have played an important *rôle* in the formation of the island, the body of which seems to have consisted of loose ashes, though some lava was poured out. On June 16, 1904, it had been reduced to a low reef, 1500 feet long and less than 10 feet high. Like the Bonin islands, the islands of the Iwojima group may be divided into two types, the one represented by the long extinct Minami and Kita-Iwojima, composed of agglomerate, the rest, still active and explosive, ejecting chiefly glassy ashes and rarely vitrophyric lavas, but never to such an extent as to augment themselves. The recent occurrence of two other submarine eruptions in these seas is recorded by Mr. Wakimizu.

AFRICA.

The Kamerun Expedition of Profs. Hassert and Thorbecke, the earlier stages of which were referred to in the *Journal* for August last (p. 184), has since reported to the Geographical Commission on its further proceedings, an outline of which is printed in the *Mitteilungen aus den Deutschen Schutzgebieten* (1908, No. 3). From the neighbourhood of the Kamerun mountain it made its way into the interior in a generally north-east direction, one or other of the two savants making excursions on either side in order to examine more closely the physical features of the country. The result has been to throw a good deal of new light on the general structure of this part of Africa, much of which had hardly been scientifically explored before. Broadly speaking, the country to the north-east of the Kamerun mountain appears to consist of a series of horsts and troughs, or basins of subsidence. In the neighbourhood of Johann Albrechtshöhe the Bakundu lowland—which forms, according to the German travellers, part of the West African rift-valley—divides into two branches, the western of which (traversed by the Bali road) runs north to the region of the Cross river and the Benue. The eastern branch, which the travellers followed on their outward journey, is formed by the trough of the Mungo and Kidde valleys, running between the horsts of the Bafarami and Kupe ranges to the great basin of the Mbo plateau, while from its floor rises the great volcanic mass of Manenguba. This trough is terminated by the steep escarpment of the Mbo range, which is composed of granite and primitive rocks, and marks the beginning of the grassy upland of the Northern Kamerun. On the road to Bamenda, however, traces of vulcanicity are seen, especially in the neighbourhood of the Bambulue basin, near which the volcano of Muti rises to 10,000 feet. The whole of the upland region is characterized by granite, gneiss, and mica-schists (often overlain by extensive outpourings of basalt and trachyte), and forms a

dissected plateau, composed of gently sloping eminences, separated by an irregular system of valleys. It falls by steep escarpments in various directions. Belts of Raphia palms line the watercourses, and the expanses of bright-green grass are broken here and there by groups of trees or bush. The settlements lie in extensive groves of plantains and oil palms, but much of the surface is uncultivated, for the density of population is here much less than has been supposed, while, on the other hand, that of forest-belt has been underestimated. In certain parts of the grassland the climate might be suitable for European agricultural settlements; but any attempt in this direction would be attended with risk. The more advanced political organization of the grasslands facilitates travel, while the roads are also better here than in the forest-belt.

African Boundary Surveys.—It may be useful to record the progress made during the present year with various surveys for the demarcation of African boundaries. The field-work of two important commissions—that for the marking of the frontier between Northern Nigeria and the French Sahara, and that for the exact survey of the region traversed by the Uganda-Congo State frontier—was completed during the first half of the year, though in the case of the latter the final adjustment of the frontier remains to be effected by negotiation in Europe. It may be hoped that this will make some definite progress now that the future political status of the Congo has been settled by the decision of Belgium to take over the State as a Belgian colony. The surveys along the line of the Nigeria-Kamerun frontier between the Cross river and Yola are still in progress, the two commissions having returned to the task during the present autumn. Some account of the work accomplished during the first season is given in the *Deutsches Kolonialblatt* for September 15 last. The triangulation on which the survey is based was connected with that of the boundary survey between Yola and Lake Chad. It was carried out by the two parties independently, the chains of triangles being, however, of course, linked together in the centre. The two surveys are said to have shown a satisfactory agreement, both as regards the co-ordinates of points and the cartographic representation of the country. The work was much impeded by the difficulties of the country, the unhealthy climate (the leader of the German section, Major Haering, has been forced to retire from the work and has been succeeded by Lieut. von Stephani), the hostility of the natives, and other causes, but about half the survey was completed, viz. to 7° 40′ N. Another boundary, which is at present occupying the attention of a survey-commission, is that between Togo and Dahome, the preliminary survey, carried out in 1898, having been considered not sufficiently precise for the final delimitation. The work, which is expected to occupy eight months, has lately been begun (*Globus*, vol. 94, No. 10). The delimitation of the Franco-Liberian boundary (*Journal*, vol. 30, p. 105) is also in progress. France is represented by M. Richaud and others, Liberia by MM. Naber and Moret, officers of the Dutch navy. From Konakri the two parties proceeded by rail to the interior, reaching Farana in June last, *en route* for the upper course of the Makona at the north-western end of the inland frontier. On the opposite side of the continent, Major Gwynn has organized an Expedition for the demarcation of the southern boundary of Abyssinia (which has been arranged), while a survey has lately been carried out along the mutual frontier of German and Portuguese East Africa.

Lieut. Cortier's New Expedition.—Lieut. Cortier, whose previous work in the Sahara has more than once been referred to in the *Journal*, has been entrusted with the command of a new expedition, the principal object of which is to obtain by astronomical observations a trustworthy basis for the map of the southern part of the French Sahara. According to the August number of the *Revue Française*, he was to go south from Algeria, and, after being joined by Lieut. Niéger, to

take the route to Air by the east of the Hoggar plateau. Further points on the proposed line of route are the Eastern Adrar, Kunta, Azauad, and Taodeni, from which last Lieut. Cortier hopes to return by way of Senegal.

Dr. Pöch's Expedition in South Africa.—Further reports of the progress of this expedition (*Journal*, vol. **30**, p. 334; **31**, p. 667) have been received at Vienna. Reaching Oas, in German South-West Africa, on January 30, 1908, the traveller occupied himself here and elsewhere with anthropological measurements and photography of the Bushmen, taking also kinematograph records of their dances. At the time of writing he proposed to make an early start for Rietfontein. The rainy season, which had just passed, had brought but little precipitation, the February amount, on fourteen days, being only 90 millimetres (3·5 in.; heaviest fall at one time 22·8 millimetres, or 0·9 in.), and that for March, on two days, only 8 millimetres (0·3 in.). Dr. Pöch's intention was to devote his most serious work to the Bushmen of the Khanseveld.

AMERICA.

The Alaska Boundary Demarcation.—In accordance with the provisions of the convention under which the Alaska boundary was submitted to arbitration in 1903, commissioners were appointed by Great Britain and the United States within a few months of the promulgation of the award, for the marking on the spot of that part of the boundary which had been the subject of dispute. The work has been energetically prosecuted under the joint superintendence of Dr. W. F. King, chief astronomer for Canada, and Mr. O. H. Tittmann, of the Coast and Geodetic Survey of the United States. Reports of progress by both these commissioners have lately been received, though neither of them brings the statement of work done beyond the end of 1907, and Dr. King's report, which forms part of the annual report of the Department of the Interior for 1905–6, is dated in October of the latter year. Mr. Tittmann's report has appeared in the *Proceedings of the American Philosophical Society* for the present year (pp. 86–90). The work which devolved on the commissioners was to identify the peaks marked on the maps used by the arbitration tribunal, to establish their geographical position, to mark by monuments the turning points of the line and such other points as might be necessary, and to describe and define the line between the points selected by the tribunal. Over a stretch of about 120 miles additional surveys had to be made, and peaks selected within certain prescribed limits to fix the boundary. Early in 1908, Mr. Tittmann reported that the commissioners had fixed trigonometrically all the peaks except two near Mount St. Elias and those in the region between the Whiting river and Devil's Thumb, and some of the peaks south of the Unuk river. The passes, valleys, and river crossings had been monumented with the exception of the crossing of the Alsek in the north, and the valleys of the affluents of the Iskut and the crossings of the Le Duc and Chicamin rivers in the south. The turning points of the water-boundary in Portland canal also remained to be fixed by reference to points on shore. This demarcation was not concerned with that part of the boundary which follows the 141st meridian, which had never been in dispute, but by the treaty signed at Washington in August, 1906, provision was made for the survey and demarcation of this line also, under the same commissioners. Owing to local deflection of the plumb-line the astronomically determined position of the meridian in question could not be relied on to be a straight line, and it was therefore determined to fix exactly the point at which that meridian is crossed by the telegraph line along the Yukon, and then trace a north and south line through this point. Before the close of the summer of 1906, a telegraphic determination of the intersection of the Yukon by the 141st meridian had been completed, the Canadian

party under Dr. Klotz effecting an interchange of signals between Vancouver and the boundary, while the American observers connected the latter with Seattle by way of Sitka, Valdez, and Fort Egbert. The circuit was closed by determining the difference between Seattle and Vancouver, and a very satisfactory agreement obtained. The transit pier erected for the exchange of time signals was found to be in longitude 141° 0′ 0″·4, a very close hit, as Mr. Tittmann remarks, while the final longitude differed by only 410 feet from that obtained by moon culminations about twenty years before. The work of tracing the boundary southward from the Yukon, begun in 1907, was in that year carried on for a distance of about 120 miles, while it was to be continued as far as possible during the summer of this year.

Standard Time for Peru.—The *Zeitschrift* of the Berlin Geographical Society (1908, No. 7) records the fact that a standard time has been lately adopted by Peru, viz. that of the 75th meridian west of Greenwich, which divides the country almost equally into an eastern and a western section. It will coincide with the time in use in the eastern United States, also determined by the 75th meridian, which passes very near the city of Philadelphia.

Expeditions in South America.—We learn from *Globus* (vol. 94, No. 11) that Dr. Farabee's expedition to Peru and Bolivia, which went out early in 1907 under the auspices of the Peabody Museum (*Journal*, vol. 29, p. 229), has already carried out some valuable work (more particularly in ethnology) in the region of the headwaters of the Madeira. From Arequipa the expedition went *viâ* Tirapata and the Aracoma pass to the Tambopata, which was navigated to its junction with the Madre de Dios. After further work in the region of the Mamore, it made its way to Santa Rosa and Cochabamba, and thence by Lake Titicaca back to Tirapata. Two members of the party have returned to the United States, but Dr. Farabee is continuing his investigations with the aid of his third companion, Mr. Horr. In the tenth number of the same periodical it is announced that Mr. R. R. Schuller (who, according to the 'Geographen-Kalendar,' is, or was till lately, keeper of the ethnological section of the National Museum at Montevideo) has undertaken a journey for linguistic and anthropological research in Eastern Peru, during which he hopes *inter alia* to visit some of the wild tribes of the Ucayali basin. The Andean tableland is the objective of an expedition undertaken by Dr. Walter Knocke, who, according to the *Zeitschrift* of the Berlin Geographical Society (1908, No. 7), started in August, accompanied by his wife. He expects to be absent two years, his object being to carry out various physical researches in the region selected. These will include investigations of atmospheric electricity, and of the radio-activity of the air, water and soil, as well as careful observations in regard to meteorology, including in particular solar radiation.

AUSTRALASIA AND PACIFIC ISLANDS.

Observations on the Great Barrier Reef.—During the year 1906 Messrs. C. Hedley, of the Australian Museum, Sydney, and T. G. Taylor, of the Geological Department of the University of Sydney, carried out careful traverses of three different reefs, in various and progressive stages of growth, in the neighbourhood of Cooktown, Queensland, with a view to obtaining definite information as to the superficial geological structure and distribution of life along actual sectional lines. The data thus obtained were put before the meeting of the Australian Association at Adelaide last year in a paper of which a reprint has lately been received, and in which the authors, besides describing in detail the results of their observations, draw conclusions as to various questions connected with the formation of reefs,

and the general physical history of Eastern Australia and the Great Barrier reef. One of the special points touched upon is that of the origin of "Negroheads," the term first applied by Flinders to the rows of crags irregularly disposed along the crest of many of the reefs of the Great Barrier, and formed of masses of dead coral 5 or 6 feet in height and of nearly equal breadth. Whilst Agassiz held them to be remnants of elevated reefs cut down by erosion, the writers agree with Saville Kent in regarding them as jetsam flung up by hurricanes; showing that they do not continue down to the ground, and always occur on the windward side of the reefs, or that on which an elevated reef would be soonest attacked by denudation. As regards the cycle of growth of an individual reef, the writers hold that if the nascent reef reaches the surface across the wind, its extremities are gradually produced so that it forms a crescent with the convexity to windward. As the process continues the shape becomes a horseshoe, and lastly an oval, enclosing a lagoon. If there is no continued subsidence, the walls broaden, while the lagoon eventually becomes filled up by the *débris* constantly transported across the reef by the water. In this way the so-called "cays," or flat wooded islands of coral origin, are held to have originated. The hilly timbered islands, which represent another type along the Queensland coast, are regarded as evidently due to a subsidence of the coast-line, which may have amounted to as much as 200 feet, and which, in the writers' opinion, is also evidenced by the form of the coast-line (its drowned valleys, etc.), and the separation of the Cape York peninsula from New Guinea. With this subsidence is correlated a probable elevation of the Australian interior between the 135th and 140th meridians as indicated by the large areas of Tertiary deposits, the two movements seeming to be due to a tectonic rocking about the north and south mountain axis. As further indications of subsidence in the Barrier region, the authors point to the steepness of its outer face as shown by recent Admiralty surveys, and to the ejections of dolomitic coral blocks by the extinct volcano of the Murray islands. However this may be, they show no reason for believing that subsidence must be a universal accompaniment of coral-reef formation.

German Ethnological Expedition to the Bismarck Archipelago.—This expedition, which was organized a year ago by the Prussian Ministry of Education, and placed under the direction of Dr. Emil Stephan, has been unfortunate in losing its leader during the past summer. Dr. Stephan, who was a young and promising ethnologist (see reviews of works from his pen in the *Journal*, vol. 30, pp. 204, 205), died in New Mecklenburg on May 25. The leadership of the expedition has, we learn from *Globus*, vol. 94, No. 7, been taken over by Dr. Krämer, whose former work in the Western Pacific is well known.

POLAR REGIONS.

Swedish Expedition to Spitsbergen.—During the past summer an expedition, sent out by the Swedish Government under the leadership of the well-known geologist, Baron de Geer, has been at work in Spitsbergen, the special field of investigation being Ice fiord and the glaciers debouching thereon. A preliminary account of the work accomplished is quoted from the *Dagens Nyheter* of Stockholm in *Globus* (1908, No. 10). Before reaching Ice fiord the expedition, which included various experts in addition to the leader, visited Horn sound and Bell sound. The greater part of the previously uncharted coasts of Ice fiord had been surveyed, and a large part of it sounded, while observations of glacier-changes had been made, and other geological and zoological researches carried out. A visit was paid to the coal-mines on Advent bay, which gave signs of great activity on the part of the hundreds of people engaged in their exploitation. Shops at which goods could be bought at moderate prices were in evidence.

Expeditions in Arctic America.—Knud Rasmussen, one of the companions of the late Mylius Erichsen on his first Greenland expedition, set out in 1906 on a new expedition to the same region, from which he has lately returned to Copenhagen. During 1907 he carried out a successful sledge expedition from the Greenland side, across Smith sound, to Ellesmere Land. This was intended to be preliminary to a journey of a more extended character through the Arctic archipelago of North America, which the explorer is understood to be planning for next year, its special object being a study of the Eskimo of that region. Another expedition which has been in the field for over a year is that of Dr. F. A. Cook, well known for his previous Arctic and Antarctic journeys and for his ascent of Mount McKinley, in Alaska. This traveller set out in 1907 in the hope of pushing north towards the pole by a route to the west of Ellesmere Land, but no news had been obtained of him down to August of the present year. Some anxiety is therefore felt on his account. It may be mentioned that news of Peary's safe arrival at Etah, in northern Greenland, has been received. Mr. Stefansson, one of the members of Mr. Mikkelsen's recent Expedition to the Beaufort sea, has this year gone north for further ethnological work in the region of the Lower Mackenzie, accompanied by Mr. Anderson, a biologist.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

A New Sounding Machine for Rivers and Small Lakes.—The inaccessibility of many of the smaller lakes and tarns of mountain regions has very generally stood in the way of a measurement of their depths, even when this might be of importance in connection with their possible utilization as a source of water-power or supply. When examining the tarns of the Canton Ticino (*Journal*, vol. 28, p. 177), Prof. Garwood was impressed with the need of an instrument which would permit the bathymetrical survey of any mountain lake without the use of a boat. With the assistance of a grant from the Royal Society, he devised an experimental model which was afterwards improved and used with success on some of the tarns above alluded to. The experience thus gained has enabled him to introduce further alterations and additions, and the resulting machine is described by him, with illustrations, in the *Proceedings of the Royal Society*, Ser. A, vol. 81, p. 243. Its use may be briefly explained thus: The machine consists of two posts erected on opposite sides of the lake or river, manipulated respectively by the observer and his assistant, and connected by a line, to which is attached a float carrying a pulley for the plummet line to pass over. The post worked by the assistant merely carries a drum by means of which the float can be hauled in or let out as required. That worked by the observer is provided with two drums, accurately paired and placed on opposite sides of the post. They work on a common axle and can be coupled by means of a spring bolt. The line from the float is fed on to one drum by means of pulleys, while that from the plummet, which eventually finds its way to the other drum, is first passed over a counting machine consisting of a driving pulley marked in inches, to which are geared other counting discs registering feet, tens of feet, and hundreds of feet respectively. The posts having been suitably fixed, the two drums on the observer's post are coupled, the counting machine is set to zero, and the float hauled out by the assistant to a given distance, which is registered by the discs. The drums are then uncoupled, and the sounding line is allowed to run out until the plummet touches the bottom, when the depth is obtained by deducting the distance of the float from the post, from the total registered by the counting machine. The line is then wound in, the drums are coupled again, the float is hauled to a new position and a second sounding taken. The machine is provided with various contrivances for checking undue speed, maintaining an even tension, preventing piling

of the lines on the drums, and so on. The counting machine is marked with two sets of figures, in black and red, registering in opposite directions, and so recording either the amount of line let out or the amount drawn in. The apparatus can easily be carried by one man even in mountain districts, and it seems eminently adapted for the purpose for which it is intended, the slight degree to which it is affected by an ordinary breeze, and the automatic record supplied by it of the depth and position of each sounding, being particularly valuable features.

German Oceanographical Expedition.—According to a statement by Prof. Schott in the *Annalen der Hydrographie* (1908, No. 9), Dr. R. Lütgens, of Hamburg, has undertaken, at the instance of the German "Seewarte," an expedition with the special object of experimental investigations into the conditions of evaporation over the sea and their regional variation. It is pointed out that inasmuch as the sea is the source of most of the atmospheric moisture, the importance of such a study, towards the prosecution of which little has yet been done, is undoubted. The voyage will be made in the four-masted barque *Pangani*, Captain Junge, and the route chosen is that across the Atlantic and round Cape Horn to the west coast of South America. This route will, it is hoped, permit a study of evaporation under the most diverse climatic conditions.

The Humidity of the Air in Town and Country.—A recent study by V. Kremser, which appeared in the *Meteorologische Zeitschrift* for May of this year, shows the decided influence exercised by large towns on the humidity of the air in them. The writer has made a comparison of the meteorological data for Paris, Vienna, Berlin, and certain other cities of the North German plain, with those of suitably chosen stations in the country near them, the result being to show that the town atmosphere is for nearly the whole year both absolutely and relatively drier than that of the country, the difference being most marked at the height of summer, while in winter the relation may be occasionally reversed. In the case of the North German stations the mean vapour pressure for the year is 0·4 millimetre higher in the country than in the town, while the relative humidity shows, for the year, a difference of 6 per cent. These figures are more striking if we consider the normal variation of the two elements in the North German plain as a whole, that of the vapour pressure amounting at the most only to 0·9 millimetre yearly, and that of the relative humidity only to 10 per cent. The explanation is to be found in part in the difference of temperature, itself due to known causes, but in part also in the difference of absolute humidity. The higher temperature of the towns might be supposed to increase the absolute humidity by favouring evaporation. That it does not might be explained as a result of the dust and smoke in the atmosphere of towns, which favour condensation, were it not that the seasonal variation does not accord with this supposition. The reason is rather the difference in the condition of the ground in town and country, drainage being so much more rapid in the former that the moisture contained in it, and therefore the evaporation, is less. The writer also enters into the question of the differences of humidity between town and country at various hours of the day. The variation of the vapour pressure is found to be roughly parallel with that of temperature, while in the case of the relative humidity the difference between town and country shows itself above all in the summer evenings, when it amounts to from 12 to 15 per cent.

GENERAL.

The Leeds and Yorkshire Geographical Society.—This new Society, the early steps for the formation of which were referred to in the *Journal* last March, was formally inaugurated on October 2, when an enthusiastic meeting was held in the Albert Hall of the Leeds Institute. The chair was taken by Mr. F. Wardle,

President of the Leeds Chamber of Commerce, and the audience numbered about 1000. The inaugural address was given by Sir Clements Markham, who spoke of the important geographical work done in the past by famous Yorkshiremen, beginning with John Holywood, of Halifax, known abroad as Sacrobosco, whose thirteenth-century treatise on the sphere was for two centuries regarded as the standard work on geography. Among the many other names alluded to, those of Henry Briggs, Frobisher, Luke Fox, and Captain Cook came in, naturally, for their due share of attention; while of more modern times such men as Governor Eyre, Charles Waterton, T. W. Atkinson (of Siberian fame), Richard Spruce, and others still living, were mentioned as distinguished Yorkshire geographers. This was followed by an illustrated lecture on the Andes of Peru. Sir Clements appears to have fired his audience with something of his own enthusiasm, and he was warmly thanked for his services to the new society, his omission to include himself in the roll of famous Yorkshiremen being duly rectified by subsequent speakers. A unanimous desire was expressed that the address might be printed, and it is hoped that this may be arranged for at once.

Distribution of Population in the United States: Erratum.—In Prof. Brigham's article on this subject in the October number, line 9 from the end of the article, the word "casually" should be "causally."

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are as a rule written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Balkan Peninsula. **Woods.**

Washed by four seas: An English officer's travels in the Near East. By H. C. Woods. London: T. Fisher Unwin, 1908. Size 9 × 6, pp. xvi. and 316. *Map and Illustrations. Price 7s. 6d. net. Presented by the Publisher.*

Europe. **Harms**

Erdkunde in entwickelnder, anschaulicher Darstellung, von H. Harms. Zweiter Band: Länderkunde von Europa, einschliesslich Völker- und Wirtschaftskunde. Leipzig: List und von Bressensdorf, 1908. Size 9 × 6, pp. xvi. and 500. *Maps and Illustrations. Price 5s.*

A feature in this book is the abundance of sketch-maps and diagrams, which bring home the facts in a graphic way.

Europe. **Neumann.**

Länder- und Staatenkunde von Europa (Allgemeines) und Mitteleuropa (Deutsches Reich, Schweiz, Osterreich-Ungarn). Von Dr. Ludwig Neumann. (Sonderabdruck aus: A. Scobel, Geographisches Handbuch; Fünfte . . Auflage.) Bielefeld und Leipzig: Velhagen & Klasing, 1908. Size 10 × 7, pp. iv. and 410–700. *Maps, Illustrations, and Diagrams. Presented by the Author.*

Europe—Relief. **Andrews and Dickinson.**

Notes on the orographical map of Europe. By A. W. Andrews and B. B. Dickinson. London: Macmillan & Co., 1908. Size 8½ × 5½, pp. 30. *Sketch-maps. Price 1s. Presented by the Publishers.*

A guide to the use of the map referred to in the October number (p. 445), bringing out the most important lessons to be learnt from it.

France—Corsica. **Chapman.**

Corsica: an island of rest. By John Mitchell Chapman. London: E. Stanford, 1908. Size 8½ × 5½, pp. xii. and 380. *Map and Illustrations. Price 7s. 6d. net. Presented by the Publisher.*

France—Lot. **Viré.**

Le Lot: Padirac, Rocamadour, Lacave. Guide du Touriste, du Naturaliste et de l'Archéologue. Par Armand Viré. Paris: Masson et Cie., 1907. Size 7 × 4½, pp. viii. and 310. *Maps and Illustrations. Price 4 fr. 50.*

One of an excellent series of guides to regions of France.

Italy—Abruzzi. **Macdonell.**

In the Abruzzi. By Anne Macdonell. London: Chatto & Windus, 1908. Size 8¼ × 5½, pp. x. and 310. *Map and Illustrations. Price 6s. net. Presented by the Publishers.*

Spain. **Calvert.**

Valladolid, Oviedo, Segovia, Zamora, Avila, and Zaragoza. An historical and descriptive account, by Albert T. Calvert. London: John Lane, 1908. Size 7½ × 5, pp. xxiv. and 162. *Illustrations. Price 3s. 6d. net. Presented by the Publisher.*

Sweden—Fauna. *Arkiv Zoologi* **4** (1908), No. 5: pp. 136. **Théel.**

Om utvecklingen af Sveriges zoologiska hafsstation Kristineberg och om djurlifvet i angränsande haf och fjordar. Af Hjalmar Théel. *Maps and Illustrations.*

Sweden—Norrland. *Ymer* **28** (1908): 17–33. **Sjögren.**

Strandlinjer och issjöar vid Torneträsk. Af Otto Sjögren. *Maps, Illustrations, and Diagrams.*

Traces the contours of former glacial lakes by the aid of old shore-lines in the region of Lake Tornea.

Sweden—Norrland—Rivers. *Ymer* **28** (1908): 60–68. **Högbom.**

Till frågan om de norrländska älfvarnas vattenhushållning. Af A. G. Högbom.

On the hydrology of the rivers of Norrland.

Switzerland—Geneva. *Scottish G. Mag.* **24** (1908): 225–238, 281–290. **Dingelstedt.**

The Republic and Canton of Geneva. A demographical sketch. By Victor Dingelstedt.

Switzerland—Solothurn. **Buxtorf and others.**

Beiträge Geol. Karte Schweiz, N.F. **21** (1908): pp. xii. and 148.

Geologische Beschreibung des Weissensteintunnels und seiner Umgebung. Von Dr. Aug. Buxtorf, Dr. E. Künzli, und Dr. L. Rollier. *Maps and Sections.*

Switzerland—Zürich. **Hug.**

Beiträge Geol. Karte Schweiz, N.F. **15** (1907): pp. xii. and 128.

Geologie der nördlichen Teile des Kantons Zürich und der angrenzenden Landschaften. Von Dr. J. Hug. *Maps.*

Turkey—Albania. *Abh. K.K.G. Ges. Wien* **7** (1908): No. 1, pp. 76. **Ippen**

Die Gebirge des nordwestlichen Albaniens. Von Th. A. Ippen. *Illustrations.*

Turkey—Parga. **Ludwig Salvator**

Versuch einer Geschichte von Parga. [By the Archduke Ludwig Salvator.] Prague: H. Mercy Sohn, 1908. Size 21 × 15, pp. viii. and 220. *Illustrations. Presented by H.I.H. the Archduke Ludwig Salvator.*

United Kingdom—Dublin. ——

Handbook to the City of Dublin and the surrounding district, prepared for the meeting of the British Association, September, 1908. Dublin, 1908. Size 7½ × 5, pp. viii. and 442. *Map and Illustrations.*

Prepared under the Editorship of Prof. Grenville Cole and Mr. R. L. Praeger.

United Kingdom—Kent. **Bennett.**

The White Horse stone and its legend. By F. J. Bennett. [West Malling, 1907.] Size 8½ × 5½, pp. 12. *Illustrations.*

United Kingdom—Meteorology. *Quarterly J.R. Meteorol. S.* **34** (1908): 65–86. **Mill.**

Map studies of rainfall. By Dr. H. R. Mill. *Maps.*

United Kingdom—Scotland. **Gwinnell.**

A hill country: its physical features and their significance. By Russell F. Gwinnell. London: G. Philip & Son, 1908. Size 7½ × 5, pp. vi. and 26. *Maps. Price* 1*s. net. Presented by the Publishers.*

An instructive sketch of the surface features and scenery of the Northern Clyde basin, as determined by geological structure, etc.

United Kingdom—Scotland—Colonsay. **Wright.**

Quarterly J. Geol. S. **64** (1908): 297–312.

The Two Earth Movements of Colonsay. By William Bourke Wright. *Sketch-maps and Illustrations.*

United Kingdom—Seismology. *Geological Mag.* **5** (1908): 296–309. **Davison.**

On some minor British earthquakes of the years 1904–1907. By Dr. Charles Davison. *Sketch-maps.*

United Kingdom—Thames. *J.S. Arts* **56** (1908): 656–671. **Beadle.**

Some observations upon the underground water supplies to the Thames basin. By Clayton Beadle.

United Kingdom—Waterways. ——

Royal Commission on Canals and Waterways. Vol. iv. Returns supplied to and prepared by the Royal Commission on Canals and Waterways, 1907. Comprising the history, the extent, the capital of, and the traffic and works of the canals and inland navigations of the United Kingdom. London: Wyman & Sons, 1908. Size 13 × 8½, pp. iv. and 510. *Maps. Price* 7*s.* 2*d. Presented.*

ASIA.

Chinese Empire—Tibet. **Hedin.**

My discoveries in Tibet. By Dr. Sven Hedin. (From *Harper's Monthly Magazine*, London, Nos. 699 and 700, August and September, 1908.) Size 9½ × 6½, pp. 339–348, 545–555. *Map and Illustrations.*

An account of the journey from Shigatze to Manasarowar in 1907.

India—Assam. **Hodson.**

The Meitheis. By T. C. Hodson, with an introduction by Sir Charles J. Lyall. (Published under the orders of the Government of Eastern Bengal and Assam.) London: D. Nutt, 1908. Size 8½ × 5½, pp. xviii. and 228. *Map and Illustrations. Price* 7*s.* 6*d. net. Presented by the Publisher.*

India—Assam. **Stack and Lyall.**

The Mikirs. From the papers of the late Edward Stack; edited, arranged, and supplemented by Sir Charles Lyall. (Published under the orders of the Government of Eastern Bengal and Assam.) London: D. Nutt, 1908. Size 8½ × 5½, pp. xx. and 184. *Map and Illustrations. Price* 7*s.* 6*d. net. Presented by the Publisher.*

Japan—Hokkaido. ——

Report on the Hokkaido. (Foreign Office, Miscellaneous, No. 668, 1908.) Size 9½ × 6, pp. 48. *Price* 2½*d.*

Japan—Sea-level. *B. Imp. Earthquake Investigation Com.* **2** (1908): 35–50. **Omori.**
On the Annual Variation of the Height of Sea-level along Japanese Coasts. Second paper. By F. Omori. *Map and Diagrams.*

Japan—Topography. **Yamasaki.**
The topography of Japan. By Naomasa Yamasaki. (Reprinted from the *Encyclopedia Americana.*) Size 10 × 6½, pp. 10. *Presented by the Author.*

Malay Archipelago—Flores. **Couvreur.**
Ts. K. Nederland. Aardr. Genoots. **25** (1908): 551–566.
Een dienstreis benoorden Larantoeka (Oost-Flores), April 23–28, 1907. Door A. J. L. Couvreur. *Map.*

Malay Peninsula—Rubber. **Asimont.**
Hevea Brasiliensis, or Para rubber, in the Malay Peninsula. Notes and figures in connection with the cultivation of Para rubber. By W. F. C. Asimont. London: L. Upcott Gill, [1908]. Size 7½ × 5, pp. 64. *Presented by A. S. Ellam, Esq.*

Malay States. **Wright and Cartwright.**
Twentieth century impressions of British Malaya: its history, people, commerce, industries, and resources. Edited by Arnold Wright and H. A. Cartwright. London: Lloyd's Greater Britain Publishing Co., 1908. Size 12½ × 9½, pp. 960. *Illustrations and Map. Presented by the Crown agents for the Colonies.*

Philippine Islands. *Philippine J. Sci.* **3** (1908): 1–27. **Ferguson.**
Contributions to the physiography of the Philippine Islands. II. The Batanes Islands. By Henry G. Ferguson. *Maps, Sections, and Illustrations.*

Tibet—Kuen-Lun. *Alpine J.* **24** (1908): 133–138. **Longstaff.**
A note on W. H. Johnson's ascents in the Kuen-Luen. By T. G. Longstaff.
Shows that there is good reason for crediting the accuracy of the altitudes assigned to Mr. Johnson's highest ascents.

Turkey—Asia Minor. *Z. Ges. E. Berlin* (1908): 317–335. **Kiewel.**
Ergebnisse der Höhenmessungen von Prof. A. Philippson im südwestlichen Kleinasien im Jahre 1904. Von O. Kiewel.

Turkey—Palestine. **Masterman.**
Palestine Explor. Fund, Quarterly Statement (1908): 229–244.
Notes of a visit to Engedy, Masada, and Jebal Usdum. By Dr. G. W. G. Masterman. *Illustrations.*

Turkey—Railway. *Petermanns M., Ergänzungsheft* **161** (1908): pp. 66. **Auler.**
Die Hedschasbahn. II. Teil: Ma'ân bis El 'Ula. Auf Grund einer zweiten Besichtigungsreise und nach amtlichen quellen bearbeitet von Auler Pascha. *Map and Illustrations.*
See note in the Monthly Record for September (p. 305).

AFRICA.

Canary Islands—Volcanoes. **Brun.**
Quelques recherches sur le volcanisme au Pico de Teyde et au Timanfaya (troisième partie). Par Albert Brun; avec la collaboration . . . de H. F. Montagnier. (Extrait des 'Archives des sciences physiques et naturelles,' février 1908.) [Geneva, 1908.] Size 9 × 6, pp. 26. *Illustrations.*

German East Africa. *M. deuts. Schutzgebieten* **21** (1908): 150–156. **Mecklenburg.**
Expedition—S. H. des Herzogs Adolf Friedrich zu Mecklenburg.
Reports on the scientific results (see September number, p. 307).

Italian East Africa. *B.S.G., Italiana* **9** (1908): 672–685. **Blessich.**
Le frontiere tra l'Abissinia e la Somalia e Dancalia italiane. Di Aldo Blessich. *Map.*
See note in the June number, p. 676.

Ivory Coast. *La G. B.S.G.* **17** (1908): 201–210. **Chevalier.**
La forêt vierge de la Côte d'Ivoire. Par Auguste Chevalier. *Sketch-map.*

Kamerun. *Deutsches Kolonialblatt* **19** (1908): 521–531. **Stein.**
Eine Erkundungs-Expedition zwischen Wuri und Sanaga. Bericht des Hauptmanns Frhr. v. Stein. *Sketch-map.*
See note in the September number (p. 307).

Liberia. *Quarterly J. Geol. Sc.* **64** (1908): 313–317. **Parkinson.**
A note on the petrology and physiography of Western Liberia (West Coast of Africa). By John Parkinson. *Sketch-map.*

Madagascar. *Rev. Madagascar* **10** (1908): 241–251. **Berthier.**
Les grands lacs de Madagascar. La région du lac Itasy. Par H. Berthier.

Morocco—Atlas. *La G., B.S.G.* **17** (1908): 177–200. **Gentil.**
Itinéraires dans le Haut Atlas marocain. Par Louis Gentil. *Map and Illustrations.*

Morocco—Ports. *S.G. Comm. Paris* **30** (1908): 175–199, 313–337, 405–430. **Dyé.**
Les ports du Maroc. Leur commerce avec la France. Par A.-H. Dyé. *Sketch-map.*

Nigeria—Languages. **Brackenbury and others**
A short vocabulary of the Fulani language. Compiled by E. A. Brackenbury. Zungeru, 1907. Size 6½ × 4½, pp. 38.
Vocabulary of the Jukon language. Compiled by W. K. Fraser. Zungeru, 1908. Size 6½ × 4½, pp. 38.
Gbari grammar notes and vocabulary. Compiled by Rev. W. P. Low. Zungeru, 1908. Size 6½ × 4½, pp. 18.
English-Okpoto vocabulary. By Capt. F. F. W. Byng-Hall. Zungeru, 1908. Size 6½ × 4, pp. 20. *Presented by the Governor of Northern Nigeria.*

Nigeria—Southern. **Parkinson.**
Southern Nigeria. The Lagos province. By John Parkinson. (From the *Empire Review*, vol. 15, 1908.) Size 9 × 6, pp. 284–292.

Nigeria—Southern.
Southern Nigeria. Report on the forest administration of Southern Nigeria for 1906. Colonial Reports, Miscellaneous, No. 51, 1908. Size 9½ × 6, pp. 92. *Price* 5d.

North-East Africa—Trade-routes. *G.Z.* **14** (1908): 251–267, 312–327. **Kürchhoff.**
Alte und neue Handelsstrassen und Handelsmittelpunkte an den Afrikanischen Küsten des roten Meeres und des Golfes von Aden, sowie in deren Hinterländern. Von D. Kürchhoff.

North-West Africa. *B. Comité Afrique française* **18** (1908): 205–216. **Bernard.**
La frontière algero-marocaine (Région de Oujda). Rapport de mission, par Augustin Bernard. *Maps and Sections.*

South Africa—Historical. **Theal.**
History of South Africa since September, 1795. By George McCall Theal. Vol. 5. London: S. Sonnenschein & Co., 1908. Size 9 × 5½, pp. xvi. and 498. *Price* 7*s.* 6*d.* *Presented by the Publishers.*
This work is once more being issued in a new and revised edition, in which vols. 1 and 5 have so far appeared. The history before 1795 forms the subject of a separate series (cf. *Journal*, vol. 31, p. 554).

Spanish Guinea. *Riv. G. Col., R.S.G. Madrid* **5** (1908): 81–168. **Almonte.**
Demarcación de la frontera septentrional de la Guinea Continental Española. Por Enrique d'Almonte. *Map and Illustrations.*
Excursion effectuada en Fernando Póo. By the same. *Illustrations.*

Togo—Cartography. *M. Deuts. Schutzgebieten* **21** (1908): 145–149. **Sprigade.**
Die Kartographie Togos. Zur Vollendung der Karten in 1 : 200,000 und 1 : 500,000. Von Paul Sprigade.

Tripoli. *Petermanns M.* **54** (1908): 49–57, 78–85. **Banse.**
Das nordafrikanische Tripolis und seine Mnschîa. Von Ewald Banse. *Plan.*

West Africa. *Z. Ges. E. Berlin* (1908): 427–431. **Frobenius.**
Leo Frobenius' Forschungsreise in das Niger-Gebiet. I. Bericht.
On a journey through Senegambia to Liberia and back to Bamako.

NORTH AMERICA.

America—Historical. **Wieser.**
Die Karten von Amerika in dem Isolario General des Alonso de Santa Cruz, Cosmógrafo Mayor des Kaisers Karl V. Mit dem spanischen Originaltexte und einer kritischen Einleitung herausgegeben von Franz R. v. Wieser. Festgabe des K.

u. K. Oberstkämmer-Amtes für den XVI. Internat. Amerikanisten-Kongress). Innsbruck: Wagner'schen Buchhandlung, 1908. Size 16 × 12, pp. xx. and 60. *Facsimile-maps. Presented by Sir Clements R. Markham.*

Canada—Historical. **Egerton.**

A historical geography of the British Colonies. Vol. 5, Canada: part ii., Historical. By Hugh E. Egerton. Oxford: Clarendon Press, 1908. Size 7½ × 5, pp. viii. and 306. *Maps. Price 4s. 6d. Presented by the Publishers.*

Canada—Indians. **Mair and MacFarlane.**

Through the Mackenzie Basin: a narrative of the Athabasca and Peace River Treaty Expedition of 1899. By Charles Mair. With . . . notes on the mammals and birds of Northern Canada. By Roderick MacFarlane. Toronto: W. Briggs, 1908. Size 9 × 6, pp. 494. *Map and Illustrations. Presented by Roderick MacFarlane, Esq.*

Canada—Northern. **Chambers.**

Canada's fertile Northland: a glimpse of the enormous resources of part of the unexplored regions of the Dominion. Evidence heard before a Select Committee of the Senate of Canada during the Parliamentary Session of 1906–7, and the report based thereon. Edited by Captain Ernest J. Chambers. Ottawa: Government Printing Bureau, 1908. Size 10 × 6½, pp. 140. *Illustrations, and Maps in Separate Case. Presented by the Minister of the Interior, Canada.*

Mexico—Archæology. **Batres.**

Civilización prehistórica de las Riberas del Papaloapam y Costa de Sotavento. Por Leopoldo Batres. (Pp. 6.) Exploraciones y consolidación de los monumentos arqueológicos de Teotihuacan. By the same. (Pp. 6.) Reparación y consolidación del Edificio de las Columnas en Mitla. By the same. (Pp. 8.) Mexico, 1908. Size 11 × 8. *Illustrations. Presented by Sir Clements R. Markham.*

United States—Arizona. **Merrill.**

Smithsonian Misc. Coll. **50** (No. 178, 1908): 461–498.

The meteor crater of canyon Diablo, Arizona: its history, origin, and associated meteoric irons. By George P. Merrill. *Plans and Illustrations.*

United States—California. *Riv. G. Italiana* **15** (1908): 291–299. **Costanzi.**

I risultati della revisione della triangulazione in California dopo il terremoto del 18 Aprile 1906. Del Ten. Giulio Costanzi. *Sketch-maps.*

United States—California. **Gannett and Baldwin.**

U.S. Geol. Surv. B. **342** (1908): pp. 172.

Results of spirit-levelling in California, 1896 to 1907 inclusive. By S. S. Gannett and D. H. Baldwin.

United States—Magnetism. *Science* **27** (1908): 812–816. **Bauer.**

Some results of the magnetic survey of the United States. By L. A. Bauer. *Map.*

See note in the August number (p. 188).

United States—Meteorology. *American J. Sc.* **25** (1908): 413–430. **Bigelow.**

The relations between the meteorological elements of the United States and the solar radiation. By Frank H. Bigelow. *Diagrams.*

United States—South-West. **Hough.**

Bureau of American ethnology. Bulletin 35. Antiquities of the upper Gila and Salt river valleys in Arizona and New Mexico. By Walter Hough. Washington, 1907. Size 9½ × 6, pp. 96. *Maps, Plans, and Illustrations.*

United States—Vermont. **Merwin.**

B. Museum Comp. Zoology, Harvard; Geol. Ser. **8** (1908): 307–330.

Some late Wisconsin and Post-Wisconsin shore-lines of North-Western Vermont. By Herbert E. Merwin. *Map, Section, and Illustrations.*

United States—Waterways. *J. Franklin I.* **165** (1908): 325–344. **Haupt.**

The waterways problem. By Lewis M. Haupt. *Illustrations.*

Cf. note in the July number (p. 89).

United States—Wyoming. **Veatch.**

U.S. Geol. Surv., Prof. Paper No. 56 (1907): pp. vi. and 178.

Geography and geology of a portion of South-Western Wyoming, with special reference to coal and oil. By A. C. Veatch. *Maps, Sections, and Illustrations.*

CENTRAL AND SOUTH AMERICA.

Brazil. **Ihering.**

Sammlung Göschen. Landeskunde der Republik Brasilien; Estados Unidos do Brazil. Von Bel. Rodolpho von Ihering. Leipzig: G. J. Göschen, 1908. Size 6 × 4, pp. 168. *Map and Illustrations. Price 80 pfg. Presented by the Publishers.*

No. 373 of this excellent series, giving a brief outline of the geography of Brazil on a scientific basis.

South America—Waterways. **Rodríguez del Busto.**

A. Rodríguez del Busto. América del Sur: Altitudes y Canalización. Tomo 1. Cordoba: Imprenta Argentina, 1908. Size 10 × 6½, pp. 238. *Presented by the Publishers.*

Discusses possible improvements in the waterways of South America.

AUSTRALASIA AND PACIFIC ISLANDS.

New Guinea—Dutch. [**Meyjes, Rochement, and others.**]

De zuidwest Nieuw-Guinea-Expeditie 1904–5, van ket Kon. Ned. Aardrijkskundig Genootschap. Leyden: E. J. Brill, 1908. Size 10 × 6, pp. xxvi. and 676. *Map and Illustrations. Presented by the Netherlands Geographical Society.*

Pacific Islands. **Russier.**

Henri Russier. Le partage de l'Océanie. Paris: Vuibert et Nony, 1905. Size 10 × 6½, pp. xii. and 370. *Maps and Illustrations. Price 6s.*

An historical account of the relations of European nations with the Pacific.

POLAR REGIONS.

Antarctic—British Expedition. ——

National Antarctic Expedition, 1901–1904. Meteorology. Part I. Observations at winter quarters and on sledge journeys, with discussions by various authors. Prepared under the superintendence of the Director of the Meteorological Office with the Co-operation of a committee of the Royal Society, 1908. Size 12½ × 9, pp. xiv. and 548. *Maps and Illustrations. Presented by the Royal Society.*

Antarctic—British Expedition. ——

National Antarctic Expedition, 1901–1904. Natural History; vol. 4. Zoology (Various Invertebrata). London: British Museum, 1908. Size 12½ × 9½, pp. iv. and [282]. *Illustrations. Price 35s. Presented by the British Museum (Natural History).*

Each paper is paged separately.

Antarctic—British Expedition. ——

National Antarctic Expedition, 1901–1904. Physical observations, with discussions by various authors. London: Royal Society, 1908. Size 12½ × 9, pp. vi. and 192. *Maps, Illustrations, and Diagrams. Presented by the Royal Society.*

Antarctic—French Expedition. **Charcot and others.**

Expedition Antarctique Française (1903–1905) commandée par le Dr. Jean Charcot. Sciences naturelles: Documents scientifiques. Arthropodes, par E.-L. Bouvier, H. Brölemann, Y. Carl, P. Lesne, R. Du Buysson, E. Roubaud, L. G. Neumann, E. Simon, Trouessart, et I. Trägärdh; Botanique, par J. Cardot et J. Hariot; Vers, par Ch. Gravier, P. Hallez, A. Railliet, et A. Henry; Mammifères pinnipèdes, Oiseux, et Documents Embryogéniques (oiseaux et phoques), par E. L. Trouessart, A. Menegaux, et le Dr. Anthony. Paris: Masson & Cie., 1907. Size 11 × 9. *Maps and Illustrations. Presented by the Ministère de l'Instruction Publique.*

Antarctic—German Expedition. **Drygalski.**

Deutsche Südpolar-Expedition, 1901–1903. Herausgegeben von Erich von Drygalski. II. Band, Heft 3. Berlin: G. Reimer, 1908. Size 14 × 10½. *Illustrations. Presented by the Reichsamt des Innern, Berlin.*

MATHEMATICAL GEOGRAPHY.

Navigation. **Miremont.**

Practical coastal navigation, including simple methods of finding latitude, longitude, and deviation of the compass. By Comte de Miremont. London: J. D. Potter, 1908. Size 8½ × 5½, pp. 88. *Chart and Diagrams. Price 4s. Presented by the Publisher.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geology. **Scott.**

An introduction to geology. Second edition. By Dr. William B. Scott. New York: Macmillan Co., 1907. Size 8 × 5½, pp. xxviii. and 816. *Maps and Illustrations. Price* 11*s. net. Presented by the Publishers.*

A clear and well-arranged text-book, with instructive illustrations. The first edition, which appeared ten years ago, has been carefully revised.

Geophysics and Biogeography. **Simroth.**

Die Pendulationstheorie. Von Dr. Heinrich Simroth. Leipzig: K. Grethlein, 1907. Size 9½ × 6½, pp. xii. and 564. *Maps. Price* 12*m. Presented by the Publisher.*

The writer attempts to account for the facts of geological history and biological distribution by supposing a secular swinging of the Earth's axis.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. **Keltie.**

Applied geography: a preliminary sketch. By Dr. J. Scott-Keltie. Second edition. London: G. Philip & Son, 1908. Size 7½ × 5, pp. viii. and 200. *Maps. Price* 2*s.* 6*d. Presented by the Publishers.*

The book has been thoroughly revised for this edition, many sections being rewritten, and a new chapter added.

Anthropogeography—Communications. **Ryves.**

The King's Highway: the nature, purpose, and development of roads and road systems. By Reginald Ryves. London: The St. Bride's Press, [1908]. Size 11½ × 8½, pp. viii. and 96. *Illustrations. Price* 5*s. Presented by the Publishers.*

A sane and judicious discussion of the road-problem.

Commercial—Rubber. **Wickham.**

On the plantation, cultivation, and curing of Pará Indian rubber (*Hevea Brasiliensis*), with an account of its introduction from the West to the Eastern Tropics. By H. A. Wickham. London: K. Paul & Co., 1908. Size 8½ × 5½, pp. vi. and 78. *Map and Illustrations. Price* 3*s.* 6*d. net. Presented by the Publishers.*

Historical Geography. **Dann.**

Historical geography on a rational basis. By Ernest W. Dann. Europe, vol. 2. London: J. M. Dent & Co., 1908. Size 7 × 5, pp. xii. and 216. *Maps. Price* 5*s. Presented by the Publishers.*

BIOGRAPHY.

Richardson. **Childers.**

A mariner of England: an account of the career of William Richardson from cabin boy in the Merchant Service to warrant officer in the Royal Navy (1780 to 1819), as told by himself. Edited by Colonel Spencer Childers. London: J. Murray, 1908. Size 9 × 5½, pp. xvi. and 318. *Price* 10*s.* 6*d. net. Presented by the Publisher.*

GENERAL.

British Empire—Historical. **Lang.**

Outposts of Empire. By John Lang. London: T. C. & E. C. Jack, 1908. Size 8½ × 6, pp. xii. and 288. *Illustrations. Price* 6*s. net. Presented by the Publishers.*

Educational—Practical. **Davis.**

Practical exercises in physical geography. By William Morris Davis. Boston: Ginn & Co., 1908. Size 7½ × 5½, pp. xii. and 148. *Illustrations and separate Atlas* (size 8½ × 10). *Price* 3*s.* 6*d. Presented by the Publishers.*

Educational—Text-book. **Fry.**

A text-book of geography. By G. Cecil Fry. London: University Tutorial Press, 1908. Size 7 × 5, pp. xx. and 406. *Maps and Diagrams. Price* 4*s.* 6*d. Presented by the Publishers.*

Educational—Text-book. **Henderson.**

A primer of practical geography. By J. W. Henderson. Glasgow: R. Gibson & Sons, 1908. Size 7½ × 4½, pp. 124. *Maps and Diagrams. Price* 1*s.* 4*d. Presented by the Publishers.*

Educational—Text-book. **Young.**

A rational geography. By Ernest Young. Part iii. Scales and direction, surveying, projections. Geology, flora, and fauna. Asia, Australasia. London: G. Philip & Son, 1908. Size 7½ × 5, pp. x. and 214. *Maps and Diagrams. Price* 1*s.* 6*d. Presented by the Publishers.*

Geography—Text-book. **Gregory.**

Geography: structural, physical, and comparative. By J. W. Gregory. London: Blackie & Son, 1908. Size 8 × 5, pp. vii. and 306. *Maps, Illustrations, and Diagrams. Price 6s. net. Presented by the Publishers.*

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Austria. **Deutschen u. Oesterreichischen Alpen Verein.**

Karte der Brentagruppe. Herausgegeben von der Deutschen und Oesterreichischen Alpen Verein. Scale 1:25,000 or 2·5 inches to 1 stat. mile. Vienna: G. Freytag & Berndt, 1908. *Presented by the Publishers.*

This is one of a good series of maps published from time to time by the German and Austrian Alpine Club for the use of mountaineers and tourists. In style of production it resembles the sheets of the Swiss Government survey, rockwork being shown by black vertical hachuring, contour-lines at intervals of 20 metres in black and brown, and water and glaciers blue. The topographical detail is from the survey of L. Aegerter, but the depths of the Lago di Molveno and other lakes, shown by contour-lines at intervals of 10 metres, are from the soundings of Josef Damian.

England and Wales. **Ordnance Survey.**

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Carte de la France dressée par ordre du Ministre de l'Intérieur. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: VIII.–35, St. Jean de Luz; IX.–11, Carentan; XI.–29, Bordeaux; XIV.–37, St. Girons; XVIII.–21, Nevers; XVIII.–23, St. Pourçain; XXII.–26, Lyon (sud-est); XXIII–11, Longuyon; XXV.–32, Allos: XXVI.–33, Puget-Théniers. Paris: Ministère de l'Intérieur, Service Vicinal, 1908. *Price* 0.80 *fr. each sheet.*

These are new editions.

ASIA.

Asia. **Cora.**

Asia a base fisica costrutta e disegnato dal Prof. Guido Cora. Scale 1 : 8,000,000 or 1 inch to 126·3 stat. miles. 6 sheets. Turin: G. B. Paravia e Co., [1908]. *Presented by Edward Stanford, Esq.*

A physical wall map of Asia, showing relief by a combination of vertical hachuring and green and brown colour tinting. The map would have been more satisfactory if fewer names had been given, for, as it is, the physical features lack clearness owing to a great extent to their being obliterated by the names. Political and ethnographical maps of Asia are given as insets.

China. **China Inland Mission.**

Atlas of the Chinese Empire, containing separate maps of the Eighteen Provinces of China Proper and the four great Dependencies, together with an index to all the names on the maps, and a list of all Protestant Mission Stations. Specially prepared by Mr. Edward Stanford for the China Inland Mission. London: The China Inland Mission, 1908. *Price* 10*s.* 6*d. net. Presented by the China Inland Mission.*

To all who are interested in China from a missionary point of view, or who are concerned with the commercial development of the country, this atlas cannot fail to be of the greatest value. The maps are entirely new, and have been compiled with great care under the personal supervision of Mr. John Bolton, the well-known cartographer of Mr. Stanford's establishment, from the latest surveys, route traverses, and other available sources of information, a list of which is given in the preface written by Mr. Marshall Broomhall, the editorial secretary of the China Inland Mission. The atlas consists of separate maps, on a uniform scale of 1 : 3,000,000, of the eighteen provinces of China Proper, followed by maps of the four great dependencies of Sinkiang, Manchuria, Tibet, and Mongolia, on the scale of 1 : 7,500,000. It also contains lists of the Protestant missionary stations, and a complete index to the names in the atlas, with the province or map on which each place will be found as well as its latitude and longitude. The maps are clearly drawn and printed in colours. No attempt has been made at hill-shading, hills and mountain ranges being only indicated by their names. The vexed question of the orthography of Chinese names, which has caused delay in the publication of the atlas, has finally been settled by adopting the system of the Chinese Imperial Post Office, the stated reason for which being that conformity to that spelling would be necessary in all postal and telegraphic communications with China. The relative importance of the cities and towns is indicated on the maps by the symbols used to mark their positions, and special attention has been paid to means of communication and canals, railways opened and in progress being clearly shown. The price of the atlas, 10*s.* 6*d.*, is remarkably low, considering the amount of time and labour the production has entailed.

Persia. **Topographical Section, General Staff.**

Persian gulf and adjacent countries. Scale 1 : 4,055,040 or 1 inch to 64 stat. miles. London: Topographical Section, General Staff, War Office, 1908. *Price* 1*s.* 6*d. net. Presented by the Director of Military Operations.*

Siam. **Royal Survey Department, Bangkok.**

Map of Muang Sritamarat. Scale 1 : 320,000 or 1 inch to 5 stat. miles. Map of Muangs Patalung and Sawngkla, Province of Nakawn Sritamarat. Scale 1 : 320,000 or 1 inch to 5 stat. miles. Map of the Province of Pattani. Scale 1 : 320,000 or 1 inch to 5 stat. miles. Bangkok: Royal Survey Department, 1905–07. *Presented by the Director, Survey Department, Bangkok.*

These are three maps based upon the latest Siamese Government surveys, and heliozincographed at the Royal Survey Department at Bangkok. The draughtsmanship is decidedly crude, but a considerable amount of new topographical information is to be found on the sheets.

AFRICA.

Abyssinia. **Topographical Section, General Staff.**

Map of Abyssinia. Scale 1:3,000,000 or 1 inch to 47·3 stat. miles. London: Topographical Section, General Staff, War Office, 1908. *Price* 2*s.* 6*d. net. Presented by the Director of Military Operations.*

Cameroons. **Topographical Section, General Staff.**

Map of the Cameroons. Scale 1:2,000,000 or 1 inch to 31·6 stat. miles. London: Topographical Section, General Staff, War Office, 1908. *Price* 1*s.* 6*d. net. Presented by the Director of Military Operations.*

AMERICA.

Canada. **Department of the Interior, Ottawa.**

Sectional Map of Canada. Scale 1:190,080 or 1 inch to 3 stat. miles. Sheets: 18, Wood mountain, revised to June 14, 1908; 69, Moosejaw, revised to May 28, 1908; 221, Swan river, revised to May 9, 1908; 270, Pasquia, revised to June 8, 1908. Ottawa: Department of the Interior, Topographical Surveys Branch, 1908. *Presented by the Department of the Interior, Ottawa.*

Canada. **Department of the Interior, Ottawa.**

Standard topographical map of Canada. Scale 1:250,000 or 1 inch to 3·9 stat. miles. Sheet 9 N.W., Timiskaming. Ottawa: Department of the Interior, 1908. *Presented by James White, Esq., Geographer, Department of the Interior, Ottawa.*

Canada. **Department of the Interior, Ottawa.**

Map of the Dominion of Canada. Scale 1:6,336,000 or 1 inch to 100 stat. miles. Ottawa: Department of the Interior, 1908. *Presented by James White, Esq., Geographer, Department of the Interior, Ottawa.*

A general map of the Dominion of Canada, showing railways in operation, under construction, and proposed. The areas which it is proposed to add to Manitoba, Ontario, and Quebec are indicated by tinting. Useful tables of railway mileages are also given on the map.

Central America. **Topographical Section, General Staff.**

Central America. Scale 1:1,705,000 or 1 inch to 26·9 stat. miles. London: Topographical Section, General Staff, War Office, 1908. *Price* 2*s. Presented by the Director of Military Operations.*

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during August, 1908. *Presented by the Hydrographer, Admiralty.*

New Charts.

No.	Inches.	
3696 m =	1·4	Norway:—Kvalö to Sklinden. 3*s.*
3689 m =	0·15	West Indies:—Eastern part of Haiti or Santo Domingo, including Mona passage. 3*s.*
791 m =	1·0	Windward Islands:—St. Vincent and the northern part of the Grenadines. 3*s.*
3695 m =	2·4	Chile, Smyth channel:—Mayne and Gray channels. 2*s.*
3700 m =	0·5	Ceylon:—Colombo to Galle. 3*s.*
816 m =	7·8	Ceylon:—Trincomali harbour. 3*s.*
3702 m =	2·4 7·2	Plans on the north-west coast of Sumatra:—Passages between Pulo Bras and Sumatra. Lampujang strait. 3*s.*
3694 m =	2·45	China, north coast:—Dairen wan (*Ta Lien Hwan*). 3*s.*

New Plans and Plans added.

837 m =	7·3 3·7	Alaska:—Anchorages in south-east Alaska. Plans added:—Seal cove, head of Kasaan bay. 2*s.*

Charts Cancelled.

No.	
791 Windward Islands:—St. Vincent.	New chart. St. Vincent and the northern part of the Grenadines 791

No.		
631	Chile:—Smyth channel from south entrance to Fortune bay. Plan of Mayne and Gray channels on this sheet.	New chart. May and Gray channels 3695
816	Ceylon: — Trincomali harbour and bays.	New chart. Trincomali harbour 816
219	Malacca strait:—Acheh head to Diamond point. Plans of Lampujang strait and Prots bay on this sheet.	New chart. Plans on the north-west coast of Sumatra:— Passages between Pulo Bras and Sumatra. Lampujang strait 3702
2760	Sumatra, west coast:—Acheh head to Chingkuk bay. Plan of Cedar and Surat passages on this sheet.	

Charts that have received Important Corrections.

No. 1905, England, south coast:—Southampton water. 210, England, south coast:—Hamoaze. 1777, Ireland, south coast:—Queenstown and port of Cork (outer sheet). 941*b*, Eastern archipelago:—Western portion, Sheet I. 2562, China:—Canton river. 1970, New Zealand, north island:—Auckland harbour. (*J. D. Potter, Agent.*)

Indian Ocean and Red Sea. **Meteorological Office.**

Monthly meteorological charts of the Indian Ocean north of 15° S. lat. and Red Sea, October, 1908. London: Meteorological Office, 1908. *Price 6d. each. Presented by the Meteorological Office.*

North Atlantic. **U.S. Hydrographic Office.**

Pilot chart of the North Atlantic Ocean, October, 1908. Washington: U.S. Hydrographic Office, 1908. *Presented by the U.S. Hydrographic Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Monthly meteorological charts of the North Atlantic and Mediterranean, October, 1908. London: Meteorological Office, 1908. *Price 6d. each. Presented by the Meteorological Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot chart of the North Pacific Ocean, October, 1908. Washington: U.S. Hydrographic Office, 1908. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Basutoland. **French.**

Four photographs of Basutoland, taken by Captain C. French. *Presented by Captain C. French.*

A set of 7 inches × 9 inches photographs of remarkable falls and rapids, instructive as showing the effect of erosion.

(1 and 2) The Le Bihan falls, Malutsunyane river, 630 feet high; (3) The Ketane falls, Ketane river, about 400 feet high; (4) The gorge of the Malutsunyane river below the Le Bihan falls.

India. **Varley.**

Nine photographs of India, taken by F. J. Varley, Esq., M.A. *Presented by F. J. Varley, Esq., M.A.*

(1) Simla; (2) Hills north of Simla; (3) Annandale and hills to north, Simla; (4) Hills to north of Mussoorie; (5) Rasin near Mussoorie; (6) A rose bush; (7) River Ganges at Hardwar; (8 and 9) River Jumna, on the Chakrata road.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

THE NILE

to illustrate t

CAPTAIN H

Scale 1:7,500,000 or 1 in

Miles 100 0 100

LE BASIN

e the paper by

H. G. LYONS

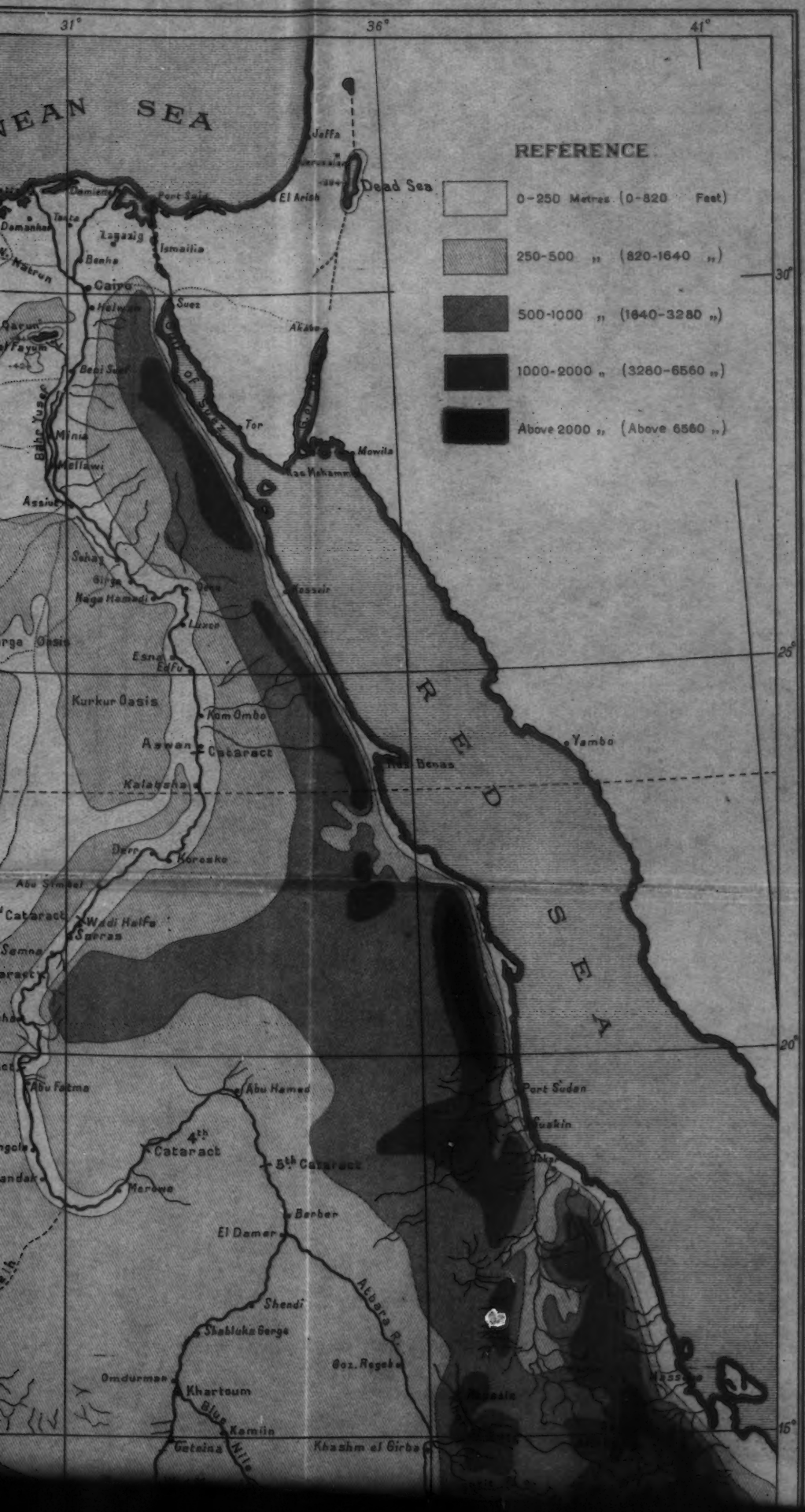
1 inch = 118 statute miles

100 200 300 Miles

THE NILE BASIN

LYONS

THE GEOGRAPHICAL JOURNAL, 1908.



El Fasher
Gebel Marrah
10°
Hofrat el Nahas
Meshra el Rek
Deim Zubeir
Wau
Tonj
Fort Gaulja
Tambura
5°
Mbomu R.
Ubangi R.
Welle R.
Bima
Ibembe
Buta
Congo R.
Basoko
Aruwimi R.
Stanleyville
0°
Maringa R.
Lomami R.
Ponthierville
21°
26°
WATERSHED

Kamlin
Gateina
Nile
Khashm el Girba
Wad Medani
El Obeid
El Dueim
Kawa
Sennar
Gedaref
Gaz Abu Guma
Karkoj
Rahad R.
Dinder R.
Gallabat
White Nile
Roseires
Renk
Kaka
Kodok
Kh. Lelle
Taufikia
Doleib Hilla
Sobat R.
Tawfot
Nasser
Bahr el Zeraf
Mongalla
Lado
Lake Victoria
15°
10°
5°
0°
31°
36°

Scale 1:10,000,000 or 1 Inch = 158 Stat. Miles.
100 50 0 100 200
Railways Open .....
" Projected .....

SEC. III.
SEC. II.
SEC. I.
Wadelai
Nile
Mahagi
Aruwimi
Lindi
Ituri
Mawambi
Irumu
GREAT PLATEAU
Sanduki
Nile
Bafwaboli
Stanleyville
Stanley Falls
Beni
Ponthierville
LAKE ALBERT EDWARD
VICTORIA NYANZA
Florence
CONGO
LAKE KIVU
Nya Lukemba
SECTION IV.
LAKE TANGANYIKA
LAKE RUDOLF

28°
CO
Lev
PROJ
UPPER CON
from
Scale 1: 2,0
SECT

Linda R.
2037 2021 2172 2365 2598
Kalunga 1807 1742 1962 1988 2076 2044 2047 2004 2017 1814 1827 1902 1849 1843 1839 1820 1880 1896 1889 1968 2037 2040
Batama
Kissanga
1732 1686 1702 1620 1565 1581 1515 1575 1492 1473 1460 1473 1351
Parala
Karanda
Bafwaboli
Mungehalolo
Ibibu
Abdallah
Stanleyville
CONGO
To Ponthierville
0°
26°
27°

To Lado
4°45′
Rejaf
To Goka
Mt. Rejaf
1998 1588 1588
Village
Vil.
1643 1597 1663 1587 1670 1647 1683 1656 1656 1620 1574 1611 1588 1653 1650 1673 1673 1742 1702 1588 1571 1571 1578 1568 1571 1574 1571 1574 1574 1574 1581 1581 1584 1591 1591 1588 1584 1584 1581 1591 1594 1584 1594 1617 1634 1597 1617 1634 1604 1604
Ft. Berkeley
Rapids
Beddeu Villages
Rapids
Rapids
River Nile
Village
Kaia
Rapids
4°30′

SECTION II.
1607 1611 1604 1650 1614 1614 1614 1611 1643 1637 1640 1637 1637 1663 1630 1637 1637 1643 1670 1663 1663 1670 1666 1672 1676 1679 1676 1679 1649 1689 1693 1693 1712 1699 1709 1699 1706 1712 1712 1716 1725 1722 1725 1722 1725 1725 1729 1735 1738 1745 1752 1756 1765 1768
Old fort
Rapids
River Nile
Village
4°15′
31°45′
31°30′
2°
SECTION III.
To Kajo Kaji
31°45′
Published by the Royal G

Projected Railways.
CONGO STATE.

29° 30° 31°

CONGO STATE

Levels along lines of PROJECTED RAILWAYS from the CONGO TO ALBERT NYANZA AND TANGANYIKA from Belgian Official Surveys

Scale 1: 2,000,000 or 1 Inch = 31·56 Stat. Miles.

Heights in feet.

SECTION IV.

2°

1°

0°

ALBERT NYANZA

L. Ruisamba

LAKE ALBERT EDWARD

LAKE TANGANYIKA

Pioke 5200 3376
Dogou 3089
Malaka 3359 2096
Giala 6148
Aluhwa
R. Ore
Nzi
Shari or Lubi
Irumu
R. Ituri
Lavya
Mawambi
R. Semliki
Malaki
Beni
R. Kabaya
R. Rutshuru
Village
Rapid

SECTION I.

32°

LADO ENCLAVE

Levels along the line of PROJECTED RAILWAY between DUFILE AND REJAF From Belgian Official Surveys

Scale 1: 250,000 or 1 Inch = 3·94 Stat. Miles

Heights in feet.

3°45'

River Nile
Omdurman
To Kajo Kaji
Village
Anjo
North Dufile
Rapid
R. Yubala
Nimule
To Wadelai
Dufile